REVISED DRAFT
Report to America on Pipeline Safety
July 28, 2011

Introductory Message from the Secretary

Over the past eighteen months there have been a number of dramatic pipeline failures that have captured the attention of the American public. From the significant loss of life in California and Pennsylvania, to the thousands of gallons of crude oil dumped into much loved waters in Michigan, Montana and Utah, many people for the first time have rightfully wondered about the safety of the pipelines that run through their communities.

As the Secretary of Transportation, in charge of the regulation of the pipelines in this country, I was also surprised by this rash of tragedies and relate to the public's concern. In response, I directed the Office of Pipeline Safety (OPS), the federal agency within the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) that is charged with regulating and overseeing the safety of the nation's pipelines, to organize a National Pipeline Safety Forum. The Forum was to allow all the stakeholders who have a part in pipeline safety to come together to examine these incidents and their implications to pipeline safety. This Forum, held on April 18, 2011, culminated in suggestions for action that OPS, states, and industry can take to improve pipeline safety. The intent of this Report is to build upon the foundation laid at the Forum to describe the factors affecting pipeline safety, to describe actions we are already taking to improve pipeline safety, and to document ideas on activities to further improve pipeline safety. To put pipelines in their proper context, this report also the purpose of pipelines in the U.S., and describes the pipeline infrastructure.

For most people pipelines are out of sight and out of mind until something goes wrong or until a new one is proposed in their area. But if you enjoy things like your hot morning shower, your heat in the winter and your air conditioning in the summer, and your ability to jump in your car and run errands whenever you want, then pipelines are a significant part of your life. The fact is that about 70% of liquid fuels (oil, gasoline, jet fuel, etc.) and nearly all natural gas is delivered to our communities, businesses, and industries by pipelines. There really is no other way to do it.

Pipeline safety statistics over the past twenty years show that pipelines have been getting safer, and comparisons with other forms of transportation (trucks, rail, barges) show pipelines to be the safer and more economical way to move fuels. But the questions still remain – are we operating our pipelines as safely as possible, and if not what changes could be made to make them even safer, to prevent the types of failures that have been in the news too often recently?

This report hopes to provide enough information to help answer those questions, so people can make up their own minds about how safe they feel around the pipelines in their communities.

Executive Summary

Everyone in the U.S. has a stake in the safe operations of pipelines. Pipeline safety is important because the vast majority of the energy we consume is from gasoline and natural gas. Most of these materials are transported through pipelines, often across hundreds or thousands of miles, to where we use them. The safety of pipelines is the shared concern not only of the people who live near them, but also of the governmental agencies - both state and federal - that regulate them, and of the companies that operate them. Our shared concern for improving pipeline safety, and for understanding what we can do to improve pipeline safety, is increasingly important since the pipeline infrastructure will continue to be a major and growing part of supplying our energy needs for a years to come.

Recognizing these facts, I have directed the Office of Pipeline Safety (OPS), the federal agency charged with regulating and overseeing the safety of the nation's pipelines - an office in the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the Department of Transportation (DOT), to prepare this Report to America on Pipeline Safety. The Report is intended to provide the American people with an overview of the role of pipelines in our lives; to describe the numerous groups having a role in ensuring pipeline safety; to summarize pipeline safety performance along

with the factors affecting performance and actions already being taking to improve safety; and to describe ideas on activities being considered to further improve pipeline safety.

The major messages in the Report are summarized below compiled under the Sections in which they are developed.

1. The U.S. Depends on the Safe Operation of Energy Pipelines

   - Everyone in the U.S. has a stake in improving the safe operations of pipelines. The vast majority of petroleum products and natural gas - materials which are fundamental to our way of life - are transported by pipelines over great distances from where they are produced to our homes and to the businesses on which we depend.

2. Roles of Key Stakeholders

   - A wide spectrum of stakeholders have important roles in assuring the safety of hazardous liquid and natural gas pipelines; key stakeholders include: pipeline operators (ranging from large multi-national companies to very small local municipalities and master meter operators), federal & state regulators, state & local officials, people living on or near pipeline right-of-ways or easements, federal and state siting agencies, developers, excavators, 811 and 911 call centers, and the public.
   - Improving pipeline safety sometimes requires significant expenditures by pipeline operators. In addition to substantial efforts expended in operating and maintaining the pipelines in compliance with the regulations, typical operator efforts involve risk assessment and management of pipeline assets, replacing and repairing pipelines, applying new technologies to better control operations, and understanding the fitness for service of pipelines.
   - Pipeline operators, generally private enterprises, charge for transportation services via rates that are typically regulated in some way by various government entities.
   - Expenditures are often difficult for pipeline operators to recover in a competitive and financially regulated environment. Most costs to improve safety are ultimately passed along to the consumers or other users of the hazardous liquids and natural gas through rate cases or other special cost transfer mechanisms.

3. Safety and Environmental Record

   - While there is clearly room for continued improvement, pipeline safety has generally been improving over more than the past twenty years; the damaging incidents that continue to occur must be prevented.

4. Challenges and Ongoing Initiatives

   - Improving pipeline safety requires that industry and regulators focus their energy and resources on understanding and managing a set of known risks.
   - To drive accidents and safety impacts to zero, pipeline operators and regulators must address a broad array of factors that contribute to current incidents.
   - Lessons from operating experience across the industry are one of the best sources of information to improve safety performance.
   - Many recognized key safety issues are already being addressed through established programs such as integrity management regulations and high-risk pipe replacement programs; programmatic improvements and accelerated pipe replacement actions may be required to meaningfully improve pipeline safety.
   - Much is currently being done to improve pipeline safety. Many new programs and requirements are not yet mature, so the benefits have yet to be fully realized.

5. Ideas for New Initiatives

   - Continued improvement of regulations, oversight, management practices, safety technology and vigilance, both by the operators and by other key stakeholders, will be needed to drive accidents and injuries to zero.

- There are important roles for all key stakeholders in continuing to improve pipeline safety. Private/Public partnerships should play an increasingly important role.

Message to the Public

There are a number of opportunities for stakeholders (including landowners, local governments, emergency responders, developers, and state and federal pipeline regulators) to involve themselves in pipeline safety. These activities include: following safe excavation practices - including calling 811 to locate any nearby pipelines before digging; monitoring and reporting suspicious activity on transmission pipeline rights-of-way; keeping rights-of-way free from obstructions and encroachments so the operator can monitor the line for signs of leakage; and following PIPA recommended practices on land use near transmission pipelines.

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1. **The U.S. Depends on the Safe Operation of Energy Pipelines**

- **Everyone in the U.S. has a stake in improving the safe operations of pipelines. The vast majority of petroleum products and natural gas - materials which are fundamental to our way of life - are transported by pipelines over great distances from where they are produced to our homes and to the businesses on which we depend.**

We as a nation are strongly dependent on energy to support our way of life. Much of the energy we consume every day is delivered to us through a vast network of pipelines. Pipelines connect places where petroleum and natural gas are produced with locations where they are used. Most of these pipelines are buried underground. As long as they operate safely they are invisible.

As illustrated in Figure 1 below, there are nearly 299,000 miles of onshore natural gas transmission pipelines and over 171,000[1] miles of hazardous liquid pipelines moving energy products throughout the U.S. every day. Approximately 71 percent of the oil and refined petroleum products and nearly 100 percent of the natural gas that we consume are transported by pipeline. In addition, the gas distribution system includes over 1.2 million miles of mains (that is, larger pipelines used to transport gas throughout a local distribution system) providing gas through nearly 900,000 miles of small diameter service lines to over 65 million customers.

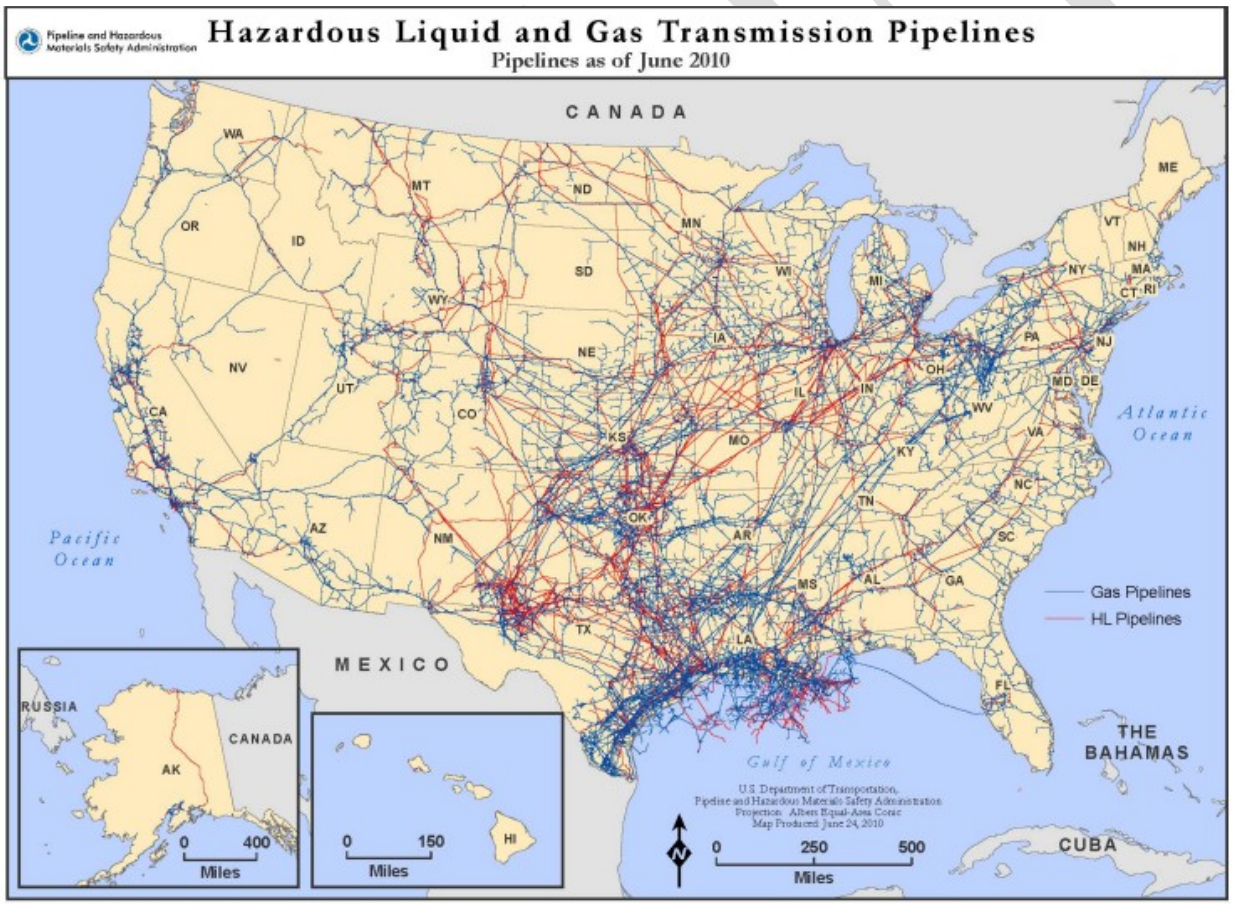

Figure 1 Hazardous Liquid and Gas Transmission Pipelines

[11] PHMSA Office of Pipeline Safety (OPS) pipeline mileage data from Annual Reports; mileage cited is from 2009 annual reports submitted as of May 2010. http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=036b52edc3c3e110VgnVCM1000001ecb7898RCRD&vgnextchannel=3430fb649a2dc110VgnVCM1000009ed07898RCRD&vgnextfmt=print

This section describes the role of the materials delivered by these pipelines in our daily lives, and identifies the various types of pipelines used to supply our energy and other needs.

Pipelines move petroleum products and natural gas to end users

Many different types of pipelines are used to transport materials to end users. Generally pipelines are categorized by the type of material they transport and by their function. The network of interconnecting pipelines is depicted in Figure 2 for natural gas system and Figure 3 for hazardous liquid system. These diagrams illustrate how pipelines transport energy and other materials from where they are produced, often hundreds or thousands of miles to where they are used.

Hazardous liquid cross-country pipelines transport crude oil, refined gasoline, propane and other highly volatile liquids, carbon dioxide, and anhydrous ammonia. Gas transmission pipelines primarily transport natural gas. Gas distribution piping systems move natural gas from gas transmission lines through large distribution lines called mains to very small service lines supplying individual residences and businesses that use natural gas. Typically cross-country pipeline operators do not own the product they transport but charge a fee for transportation services they provide. Frequently local distribution companies do own the natural gas they transport, but are usually prohibited from profiting by marking up its price other than to reflect transportation costs.

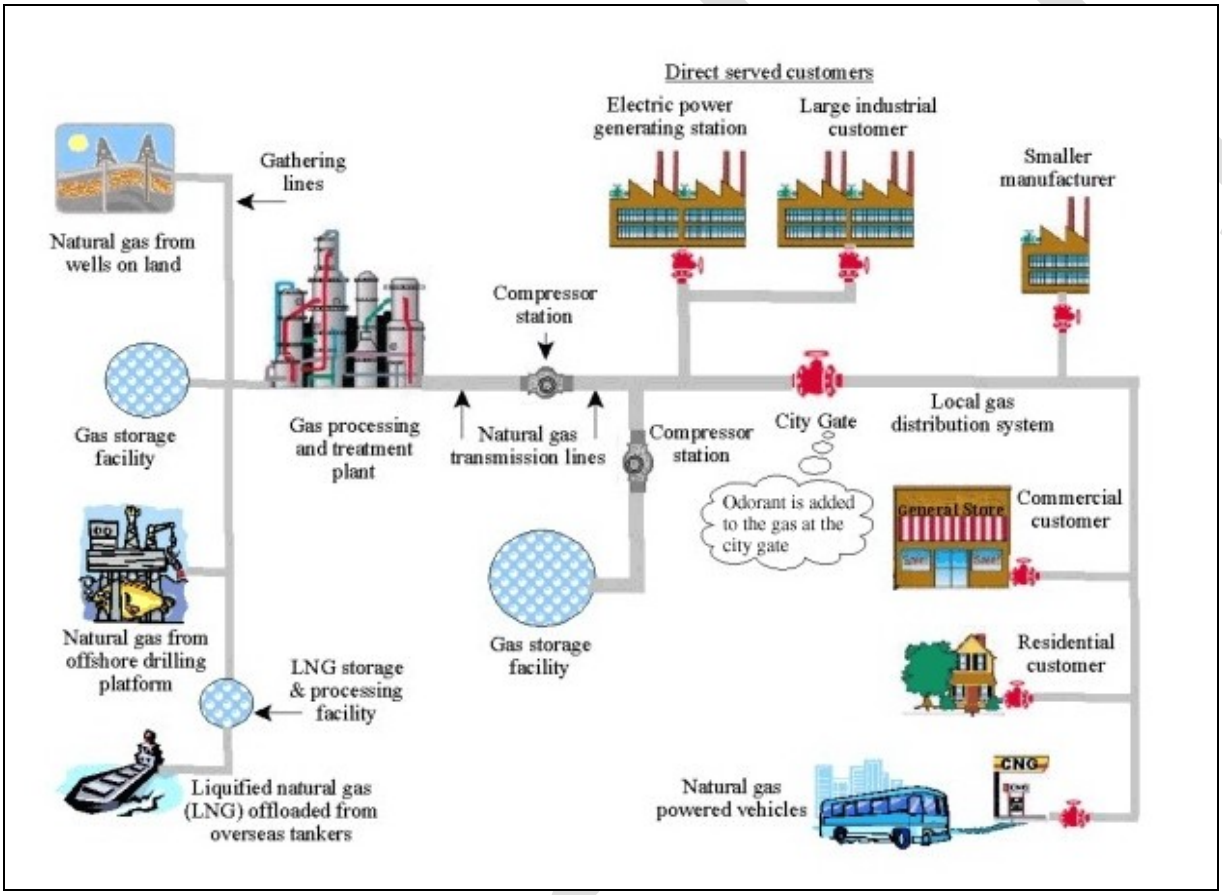

Figure 2: Natural Gas Pipeline Systems: From the Wellhead to the Consumer

Natural gas is delivered from wells and storage facilities through a network of gas conditioning and pipeline facilities to the end user as illustrated in Figure 2. Beginning at the left the figure show gathering lines used to transport natural gas from wells to processing facilities. Processing facilities prepare the gas for end use. Large diameter, generally ranging between 8 and 48 inch, cross-country pipelines transport the processed natural gas to industrial customers, power plants and local gas distribution utilities. Gas distribution utilities move the gas locally to individual residences and other users.

Gas distribution lines have delivered gas to local customers for almost 200 years. Distribution pipeline systems exist in restricted geographical areas that are predominantly urban or suburban, because the purpose of these pipelines is to deliver natural gas to end users - residential, commercial, industrial, and institutional customers. Distribution lines are generally smaller in diameter (as small as 5/8 inch) than distribution mains and cross-country lines, operate at lower pressures, and are constructed of various materials including a significant percentage made of plastic. If you use natural gas for heating your home or water, you have one of these small distribution lines on the property where you live or work.

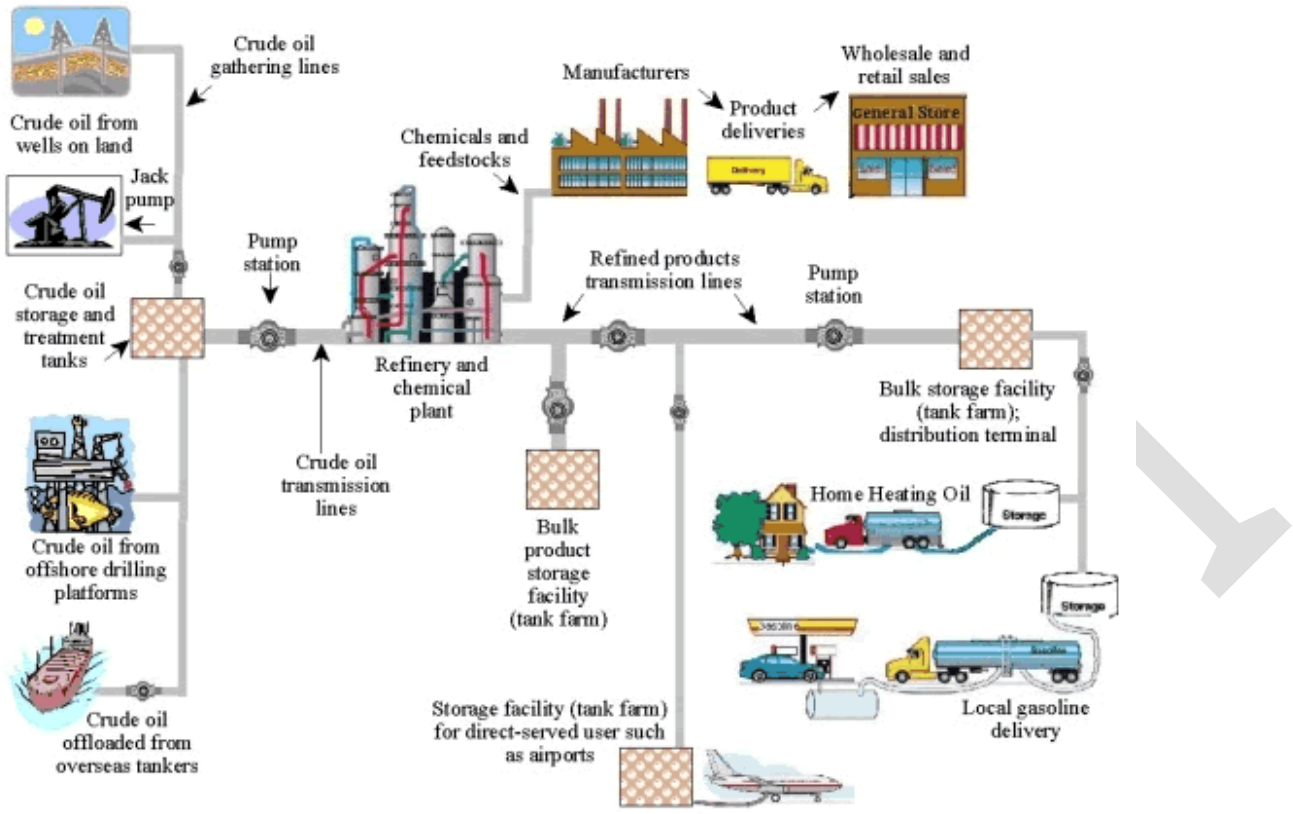

Figure 3 Petroleum Pipeline Systems: From the Wellhead to the End User

Beginning at the left, Figures 3 show gathering lines used to transport crude oil from wells to processing facilities. Liquid gathering lines supply crude oil to pump stations that feed cross-country pipelines. The nation's oil pipelines transport crude oil from oilfields to refineries where the oil is converted into dozens of useful products such as gasoline, home heating oil, jet fuel, diesel, lubricants and the raw materials for fertilizer, chemicals and pharmaceuticals. Pipelines then transport refined products to depots from which tank trucks deliver the products to end users. For example, gasoline is delivered by truck the relatively short distances to the gas stations where consumers fill their cars.

Materials transported by pipelines are integral to our daily lives

As discussed above, the vast majority of materials moved by pipeline are used to provide energy in various forms - energy to run our automobiles, to heat and brighten our homes, and to power our industries. Together petroleum and natural gas supply over 62% of total U.S. energy needs[2].

Beyond supplying materials to satisfy most of our energy needs, pipelines transport other important materials, such as anhydrous ammonia used to produce fertilizer to grow the food we eat. A recent article[3] highlighted the variety of

[2] U.S. Energy Information Administration, Annual Energy Review, 2009.

[3] "Oil Oozes through Your Life", New York Times, Stephanie Clifford, June 25, 2011.

products affecting our daily lives that are produced from petroleum. The list of products made from only 2% of the oil used in the U.S. includes: clothing (acrylic, polyester and nylon), petroleum-based fertilizer, plastic bags, laundry detergent, golf balls, personal care products (perfume, hair dye, lotions, deodorant and toothpaste), food preservatives and flavoring, vitamins and pain relievers. While this is only a partial list of the products made from materials transported by pipeline that affect our daily lives, it serves to illustrate the importance of the usually invisible pipeline transportation infrastructure.

Information from the U.S. Energy Information Administration[4] shows that the end use of the natural gas (virtually all of which is transported by pipeline) is focused on industrial (32.4%), electric power (30.2%), and residential (20.9%) applications. Petroleum products (approximately 71% of which is transported by pipeline) are used primarily in transportation (71.0%) and industrial (22.5%) applications.

Pipelines are increasing in importance as transporters of the energy materials in the U.S.

Approximately 71 percent of the oil and refined petroleum products and nearly 100 percent of the natural gas that we consume are transported by pipeline[5]. The percent of oil and refined petroleum products transported by pipelines has increased from 54% in 1990 to 71% in 2008. Water carriers, such as barges and tankers, were the second largest carrier of oil and refined products in 2008, transporting 16 percent of crude oil and 27 percent of petroleum products.

As it moves to distribution terminals, almost all gasoline is transported by pipeline. Tanker trucks delivering to the local gas station usually carry gasoline only the last few miles from a distribution terminal. In spite of the many types of pipelines involved and the distances they move petroleum products; the cost of pipeline transportation of gasoline adds only 2.5 cents per gallon at the pump.

Pipelines also serve to reduce the traffic on our highways and railways. The Association of Oil Pipelines (AOPL) estimates that replacing even a modest-sized pipeline, which might transport 150,000 barrels of petroleum products per day (there are 42 gallons in a barrel), would require 750 tanker truck loads per day, delivering a load every two minutes around the clock. Replacing the same pipeline with railroad cars would require a 225-car train to arrive and be unloaded every day.

A large number of companies of varying size operate the nation's pipeline systems

Pipelines are operated by many thousands of companies, large and small, ranging from giant multi-national corporations to small local gas distribution operations, down to master meter operators such as those that supply gas to mobile home communities. As one measure of the number of pipeline companies, there are approximately 355 hazardous liquid transmission pipeline operators that are subject to the integrity management program (IMP) regulation (the IMP regulations are discussed in Section 4) and 620 operators of gas transmission (?) lines subject to the gas transmission IMP regulation.

As reported by the American Gas Association (AGA)[6], there are approximately 9,343 distribution operators affected by the recently issued Distribution Integrity Management Program (DIMP) regulation (also discussed in more detail in Section 4). Of these operators, 201 are large local gas companies, 1090 are small local gas utilities, 52 are liquid petroleum gas (LPG) operators serving 100 customers or more from a single source, and approximately 8,000 are master meter operators and small propane systems.

Pipelines are located near many of us

The vast majority of the land where pipelines lie is not owned by the pipeline companies. Certainly the land under which the small lines supplying gas to individual residences is owned by those individuals. However, even large diameter

[4] U.S. Energy Information Administration, Annual Energy Review, 2009.

[5] "Report on Shifts in Petroleum Transportation", AOPL, January 4, 2011

[6] "AGA Response to PHMSA Request for Information", Dave McCurdy, AGA President & CEO, April 10, 2011.

pipelines that transport natural gas and petroleum products across the country are buried under land owned or controlled by others. These landowners include the public, private enterprise and state and federal government. Easements and right of way agreements allow pipelines to be constructed and operated on lands owned or controlled by others. As residential neighborhoods are developed, they often expand onto agricultural or undeveloped land where pipelines have already been buried – often decades earlier. As a consequence, safe and appropriate land use by landowners impacts pipeline safety. Appendix 6 briefly summarizes how new cross-country pipelines are sited.

Changes in energy material production and use may lead to changes in our pipeline infrastructure

The location of energy materials and patterns of energy use are changing. As these changes occur, they will lead to changing demands on the pipeline infrastructure, including the need for new pipelines and pipelines transporting a different mix of materials. Some examples of trends that may impact demands on the pipeline infrastructure are noted below.

Petroleum from Canadian Oil Sands – Vast reserves of petroleum are currently being developed in western Canada. These reserves are contained in oil-bearing sands requiring new technology for economic extraction. A major pipeline is currently in the planning stage for shipping the liquid crude from these reserves to the U.S. While both the environmental impacts of developing oil-bearing sands and of the pipelines needed to transport the product are certainly controversial, this development would reduce U.S. dependence on petroleum from the Middle East.

Shale Gas - The news has been filled with stories about our new ability to extract gas from the enormous reserves in shale formations around the country such as the Marcellus shale under the Appalachian region. While numerous questions about the environmental impact of this production have been raised, development and use of these reserves would again represent a giant step toward decreasing our dependence on foreign supplies of energy materials. The location of these reserves, however, is different from gas resources we are currently using, so significant expansion of production of shale gas will likely lead to the need to construct and operate a much larger and much different pipeline infrastructure than in place today.

Biofuels - The gasoline we purchase these days has an increasing fraction of ethanol produced from corn. U.S, policy regarding biofuels such as ethanol is in flux. If we increase our reliance on these fuels, our pipeline infrastructure will likely include new pipelines transporting different materials such as bio-gas from farms and landfills.

Carbon Sequestration - Burning carbon-based fuels such as coal to produce electricity is recognized as a major contributor to greenhouse gas emissions. One solution currently being explored is carbon sequestration, in which the carbon dioxide (CO_2) produced in burning coal is collected and stored in deep underground geological formations. If such technological solutions prove viable, it is highly likely that pipelines will play a role in transporting the CO_2 from locations where it is generated to the permanent storage locations.

Hydrogen Fuel - While the widespread use of hydrogen as a fuel in fuel cells is very likely far off, it does represent a major potential solution to both greenhouse gas emissions and dependence on foreign supplies of energy materials. If and when hydrogen becomes a significant source of energy in the U.S., pipelines will again be required to transport the hydrogen from where it is produced to where it is consumed. Pipelines are already used, albeit in transporting limited quantities short distances, to transport hydrogen.

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2. Roles of Key Stakeholders

- **A wide spectrum of stakeholders have important roles in assuring the safety of hazardous liquid and natural gas pipelines; key stakeholders include: pipeline operators (ranging from large multi-national companies to very small local municipalities and master meter operators), federal & state regulators, state & local officials, people living on or near pipeline right-of-ways or easements, federal and state siting agencies, developers, excavators, 811 and 911 call centers, and the public.**
- **Improving pipeline safety sometimes requires significant expenditures by pipeline operators. In addition to substantial efforts expended in operating and maintaining the pipelines in compliance with the regulations, typical operator efforts involve risk assessment and management of pipeline assets, replacing and repairing pipelines, applying new technologies to better control operations, and understanding the fitness for service of pipelines.**
- **Pipeline operators, generally private enterprises, charge for transportation services via rates that are typically regulated in some way by various government entities.**
- **Expenditures are often difficult for pipeline operators to recover in a competitive and financially regulated environment. Most costs to improve safety are ultimately passed along to the consumers or other users of the hazardous liquids and natural gas through rate cases or other special cost transfer mechanisms.**

Numerous stakeholders have important roles in assuring the safety of hazardous liquid and natural gas pipelines. The key stakeholders in pipeline safety are depicted in Figure 4. Representative roles played by these stakeholders are summarized in Figure 5. This section briefly summarizes the roles of each of these key stakeholders.

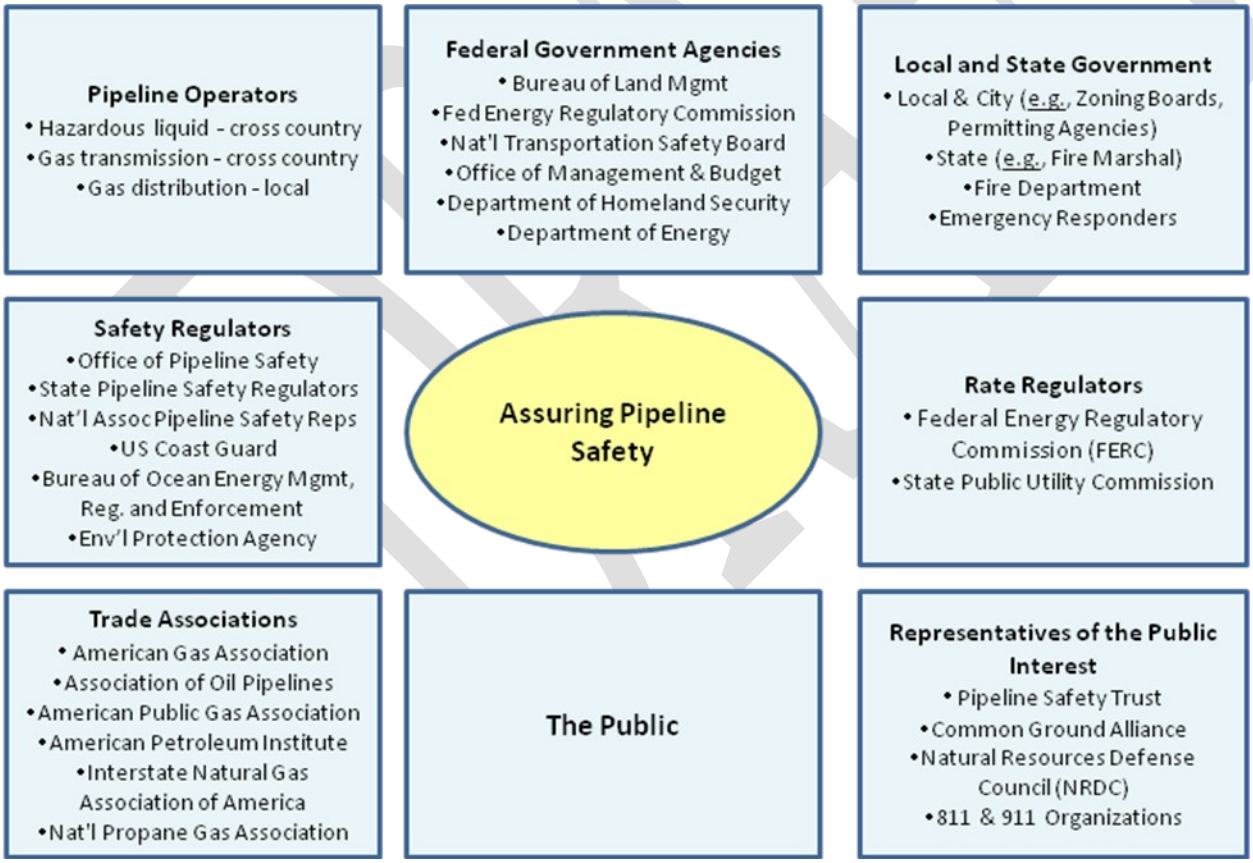

Figure 4 Key Stakeholders in Assuring Pipeline Safety

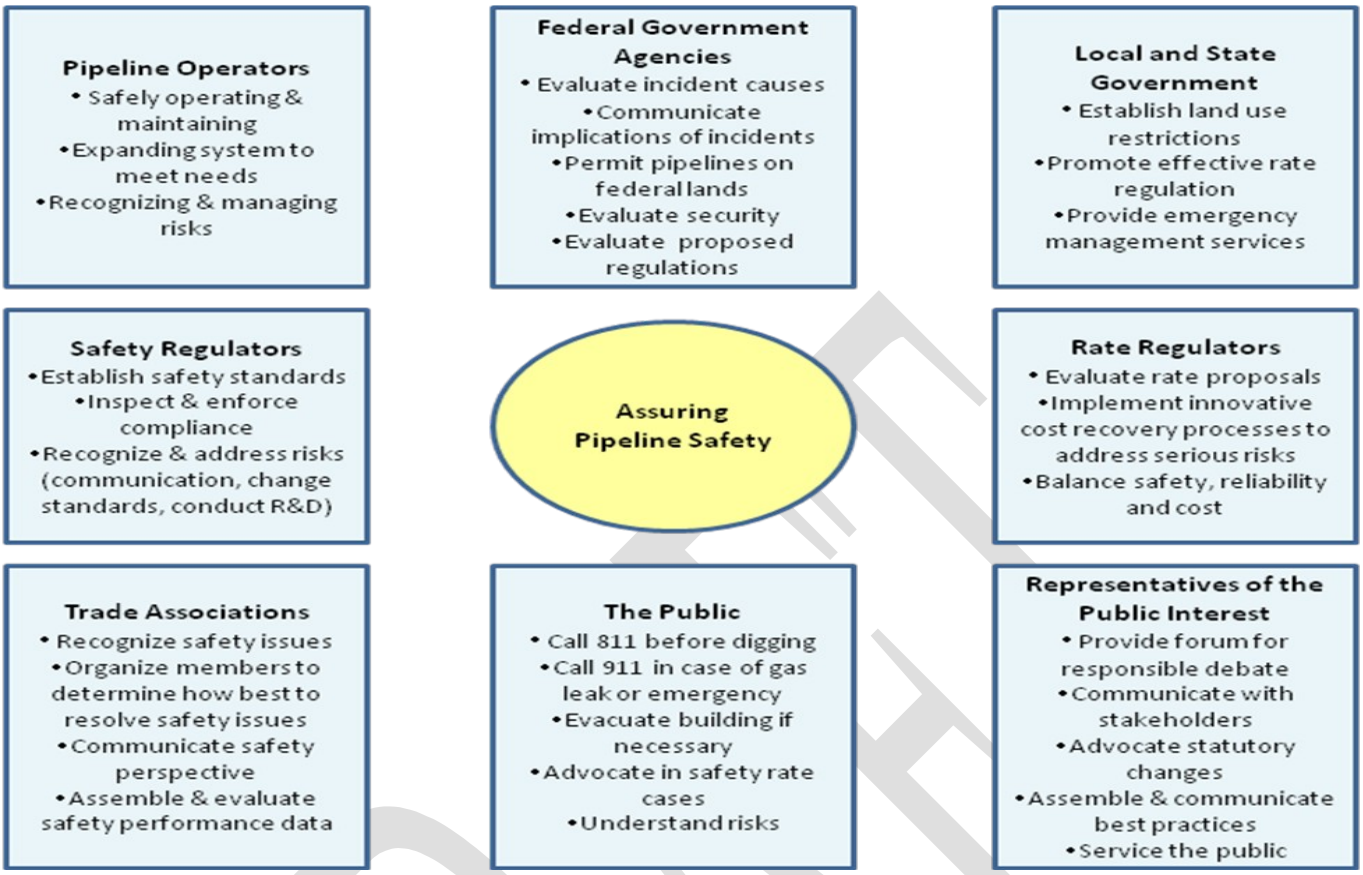

Figure 5 Examples of Key Stakeholder Roles

This Section describes the roles of state and federal safety regulators, pipeline operators, pipeline rate regulators and the public in some detail. Other stakeholder roles are treated in Appendix 9.

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Safety Regulators

A federal agency establishes and inspects compliance with minimum safety standards

The Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), administers the department's national regulatory program to ensure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline.

Two statutes provide the framework for the Federal pipeline safety program. The Natural Gas Pipeline Safety Act of 1968 as amended authorizes the Department to regulate pipeline transportation of natural (flammable, toxic, or corrosive) gas and other gases as well as the transportation and storage of liquefied natural gas. Similarly, the Hazardous Liquid Pipeline Safety Act of 1979 as amended authorizes the Department to regulate pipeline transportation of hazardous liquids (crude oil, petroleum products, anhydrous ammonia, and carbon dioxide). These Acts have been recodified as 49 U.S.C. Chapter 601.

OPS' mission is to protect people and the environment from the risks inherent in transportation of hazardous materials by pipeline. To accomplish this mission, OPS develops regulations designed to ensure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. In addition to developing the regulations that establish the safety baseline for pipeline operators, OPS manages and carries out the following responsibilities:

- Manages a national pipeline compliance inspection and enforcement program, including programs managed by its state safety partners. Regulations governing specific aspects of pipeline safety are included in Title 49 of the Code of Federal Regulations (CFR) in Parts 190 through 199.
- Evaluates the safety performance of pipeline operators under its jurisdiction, and focuses its resources to address deficient performance.
- Develops and offers pipeline safety training programs for federal and state regulatory and compliance staff and the pipeline industry.
- Develops and maintains partnerships with other federal, state, and local agencies, public interest groups, tribal governments, and the regulated industry and other underground utilities to address threats to pipeline integrity.
- Actively partners with state and local officials, first responders, pipeline operators, excavators and the general public to ensure pipeline safety.
- Identifies technical areas requiring improved understanding and manages both technical studies and research, development and demonstration programs to address priority needs.
- Provides technical and resource assistance and educational programs to public officials at the state and local level.
- Supports pipeline safety studies by the National Transportation Safety Board, DOT Inspector General, Government Accountability Office and other oversight and/or stakeholder entities. Evaluates and addresses recommendations from these bodies.

In 2011 OPS performed these functions with its approximately 196 employees, approximately 88 of whom - including attorneys - worked

What is a compliance inspection? Federal and state pipeline safety inspectors periodically visit pipeline facilities and the offices of companies that operate the pipelines to evaluate whether they are in compliance with applicable requirements. These "inspections" typically include examination of manuals and records to determine whether the operator has procedures describing how compliance is to be maintained, and whether records document the completion of needed actions described in the manuals. At pipeline facilities, "inspections" also include observation of ongoing activities as well as the physical condition of equipment. When violations are identified, inspectors use one of several available enforcement mechanisms to document the violation to ensure future correction by the operator.

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at Headquarters in Washington, DC, and the 108 worked in the five OPS regional offices located in Trenton, NJ; Atlanta, GA; Kansas City, MO; Houston, TX; and Lakewood, CO. Of these 196 people, 123 are involved in inspection and enforcement activities. Appendix 7 provides a simple description of how federal and state pipeline safety programs are funded.

OPS partners with the states in auditing pipeline safety practices

While OPS directly regulates most of the hazardous liquid pipelines in the nation, states take over when it comes to intrastate natural gas pipelines. Every state except Hawaii and Alaska is responsible for the inspection and enforcement of state pipeline safety laws for the natural gas pipeline systems within their state. Some states - about 20 percent - also regulate the hazardous liquid lines within their state borders. This cooperative, collaborative relationship between the federal and state government - the Federal/State Partnership - forms the cornerstone of the pipeline safety program.

Federal regulations represent the baseline set of regulations used by the states to oversee pipeline safety. However, each state has the authority to impose requirements on intrastate operators that go beyond the minimum set of federal standards. Many states exercise this authority to strengthen requirements to deal with threats that are either unique or of greater significance in their states (see Appendix 8 – not available until later in August).

Federal grant funds are provided to state programs to oversee pipeline safety. OPS is authorized to reimburse a state agency up to 80 percent of the actual cost for carrying out the state's pipeline safety program. Funding has not yet been appropriated by Congress to allow reimbursement at the 80% level. Currently states pipeline safety agencies employ approximately 365 inspectors who are actively engaged in inspection of pipelines to ensure their safe operation.

One area of shared responsibility in pipeline safety is damage prevention. Effective damage prevention programs are necessary at the state level to reduce the impact of excavation damage. OPS recently completed the State Damage Prevention Program Characterization (SDPPC) initiative to gain a better understanding of individual state damage prevention program and to identify program strengths as well as areas that could be improved. OPS is working with state programs on potential improvements. Appendix 5 provides more information on damage prevention programs.

Additional information about individual state programs can be found beginning at the following link:
http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=cfa64a7e1997d110VgnVCM1000009ed07898RCRD&vgnextchannel=913ac0124500d110VgnVCM1000009ed07898RCRD&vgnextfmt=print

Pipeline Operators

Pipeline operators are ultimately responsible for safely supplying the products they transport to end users. The pipeline safety regulations contained in 49 CFR Parts 190 through 199 are cradle to grave regulations addressing all aspects of a pipeline's lifecycle including design, construction, initial testing, operations and maintenance, personnel qualifications and drug testing, emergency response, all the way through abandonment. These regulations also incorporate by reference over sixty national consensus standards, which also mandate how operators are expected to comply with the regulations. These regulations provide a strong baseline for safe operation. Operators dedicate considerable resources to achieving safety by complying with these regulations. However, operators must be vigilant not only in assuring compliance with these requirements, but also in assuring all aspects of safe operation of their systems and in understanding the ever-changing risks identified through operating experience - both in their own systems and in similar systems operated by others. Some of the special programs that go beyond achieving minimum compliance with regulations are discussed in Section 4 of this report.

Recent accidents involving older pipeline have underlined the importance of having a valid basis for evaluating the fitness for service of pipelines to better assure the continued safety of people living nearby. Presently the fitness for service concept is not explicitly defined by the pipeline safety regulations. Evaluating fitness for service was described during the Pipeline Safety Forum in April of 2011 as a more appropriate process for informing decisions about repairing, replacing, rehabilitating or requalifying older pipelines than applying a single criterion such as age, material, or welding technique.

While the process and criteria for determining fitness for service are not yet consistently understood across the pipeline industry, efforts are underway to develop this understanding. It is clear, however, that many of the current regulations, including IMP, incorporate principles underpinning the determination of fitness for service. Further information on fitness for service is in Appendix 3; additional description of an operator's compliance program is located in Appendix 4.

Rate Regulators

Regulation of the rates charged by pipeline operators to transport energy materials is quite complex. Only an overview of the major participants in rate regulation is presented here. Appendix 1 treats the subject in somewhat greater detail.

Pipeline operators are common carriers whose rates are regulated by various agencies - Most pipeline companies, whether operating large pipelines transporting natural gas or petroleum products cross-country or delivering natural gas to local residences and businesses, are "common carriers". As such they are required to provide transportation services to any customer upon reasonable request. The rates charged by pipeline companies are regulated by one or more rate regulation agencies. These agencies are charged with determining how much an operator is allowed to charge for transportation services.

Local distribution companies (LDCs) are typically regulated by state agencies - Rates allowed for local distribution companies that supply gas to local residences and businesses are generally established by state rate regulators such as Public Utility Commissions (PUC) or Public Service Commissions (PSC). The rates for some local municipal distribution companies are established by the municipalities they serve. Allowed rates are established based on the cost of providing the transportation service. LDCs recover their costs through frequent, often annual, rate filings with their state commissions. To deal replacing higher risk pipe, many state commissions have implemented special programs that allow LDCs to recover their costs without having to undergo a comprehensive rate case. In these rate cases the PUC evaluates the operator's application then decides which parts of the requested rate increase will be approved by striking a balance among safety, service reliability and the cost of providing the service.

Cross-country pipeline rates are regulated by FERC - Cross-country pipeline companies do not own the product they are transporting and are paid a fee for transportation service by their customers. Pipeline operators typically pass these costs on to consumers. The Federal Energy Regulatory Commission (FERC) regulates the rates for transportation through cross country pipelines of petroleum product and natural gas. Unlike state commissions, FERC approves special rate increase provisions infrequently and almost never for capital expenditures. To recover pipeline replacement costs, an interstate pipeline must file a comprehensive rate case. In these rate cases FERC will review all of the pipeline's costs and revenues. Even if a pipeline is permitted to raise its rates to recover additional costs, such as replacing older pipe, there is the risk that customers with competitive options will seek lower cost suppliers or demand rate discounts. Discounting, sometimes significant discounting, is common.

Local and State Government

As discussed in previous sections, the state government is a major player in regulating both pipeline safety and the rates charged by local distribution companies. In addition public safety official, including the police and fire department at local level, respond to emergencies to help minimize consequences from pipeline incidents. At the state level the fire marshal is responsible for understanding causes of major fires and preparing local officials to respond to fires. In addition local officials, like planning departments, establish zoning requirements governing land use near pipelines, and other local officials are involved in permitting pipeline right-of-ways and negotiating land use agreements. Finally local officials often play a role in issuing permits to pipeline operators to construct new lines on public property (easement agreements) and to excavate existing pipelines to repair known or suspected defects.

The Public

The public is the ultimate beneficiary of the transportation services provided by pipeline operators. However, they are also often exposed to the risks represented by living or working near pipelines. The role of the public in pipeline safety includes addressing the responsibility to assure their own excavation actions do not damage near-by pipelines, and

responding to pipeline incidents near where they live or work. The public also has the opportunity to express their views on issues ranging from proposals to locate new pipelines near where they live, to supporting proposed pipeline rate increases intended to cover the costs of replacing high risk pipeline segments.

The interests and needs of the public for information include: residents understanding the location of pipelines near where they plan to dig; developers and excavators need to know where pipelines are located near areas where they are excavating; and the public in general needs to know how best to protect themselves by preventing and responding to incidents.

The Public Must Recognize, Respond to & Report Incidents - Emergencies can occur in the home or workplace, or outside, along a pipeline right-of-way. Understanding how to recognize, react and report an incident can save lives. As with other emergencies, reporting pipeline emergency is as easy as dialing 911. More information is available at the following web site http://primis.phmsa.dot.gov/comm/EmergencyResponse.htm?nocache=4695 .

OPS actively partners with state and local officials, first responders, excavators and the general public to ensure pipeline safety. All of us, in one way or another, are pipeline safety stakeholders.

Associations Representing the Public Interest - A partial listing of groups that represent the interests of the public interest, along with their web sites is shown in Appendix 9.

Industry Trade Associations

The pipeline industry is represented by a number of Trade Associations. While it is easy to think of these associations as simply representing the interests of their members to inform Congress and influence legislation, they also serve several key safety functions, including:

- Serving as a forum for bringing together member companies to discuss safety-related operational experience and to share practices they have successfully implemented in addressing safety issues;
- Gathering and analyzing operational and accident experience data, then communicating the safety implications revealed by their analysis with member companies;
- Sponsoring and assembling expert participants for national consensus standards groups that gather and integrate the continuously evolving body of knowledge on pipeline safety into standards both for informing operator safety practices and as a source for regulators in developing and updating safety regulations;
- Providing their unique perspective on the industries they represent to better inform the public on business, economic and safety issues;
- Providing their perspective to regulatory agencies on the importance of current safety issues and what regulatory changes would improve how these issues are managed.
- Providing national industry forums for federal and state regulators to inform pipeline operators on issues related to enforcement of existing regulations and the intent of pending regulations.
- Supporting regulators in identifying and facilitating areas of research that will enhance safety.

The most active industry trade associations representing the pipeline industry along with references to their web sites are discussed in Appendix 9. Specific activities sponsored by these associations that are designed to improve pipeline safety are discussed in Section 4.

3. Safety and Environmental Record

- **While there is clearly room for continued improvement, pipeline safety has generally been improving over more than the past twenty years; the damaging incidents that continue to occur must be prevented.**

As discussed above, pipelines supply a significant and increasing fraction of our energy needs. The question explored in this section is how safe and environmentally benign are pipelines in the performance of that important function.

While energy demand and pipeline mileage have increased, pipeline safety has improved

While not dismissing the importance of severe incidents that continue to occur, the overall pipeline safety record has generally been improving over the past two decades. As shown in Figure 6, over the past 22 years, all the traditional measures of risk exposure have been rising - population, energy consumption, pipeline ton-miles. During the same 22 years, the number of serious pipeline incidents - those involving death or injury - has declined by 50%. This decline has occurred while the average age of pipe in the ground has steadily increased.

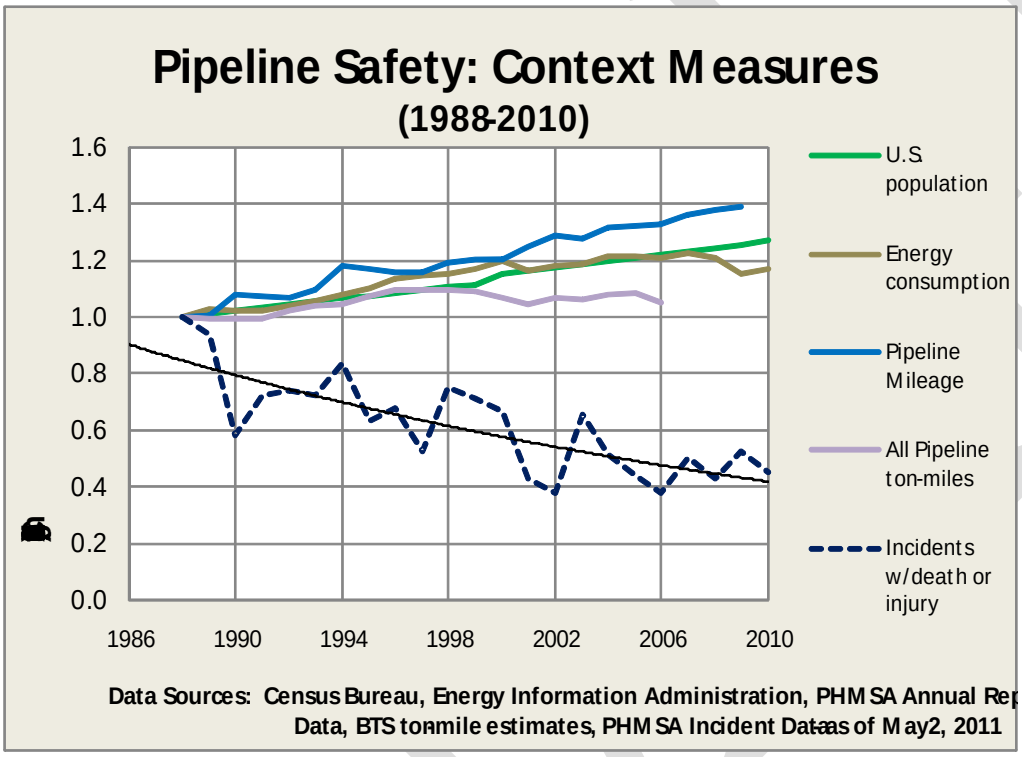


Figure 6 While Energy Demand has increased; Pipeline Incidents that Harm People have decreased

Safety Performance and Trends[7]

Risk to the public from hazardous liquid and gas transmission pipelines result from the potential for an unintentional release of products transported through the pipelines. Releases of products carried by these pipelines can impact surrounding populations, property, and the environment, and may result in injuries or fatalities as well as property and environmental damage.

[7] Much of the text in this section has been abstracted from the OPS report "Building Safe Communities: Pipeline Risk and its Application to Local Development Decisions", October, 2010.

These consequences may result from fires or explosions caused by ignition of the released product, as well as possible toxicity and asphyxiation effects. Some hazardous liquid releases can cause environmental damage, impact wildlife, or contaminate drinking water supplies. Releases can have significant economic effects as well, such as business interruptions, damaged infrastructure, or loss of supplies of fuel such as natural gas, gasoline, home heating oil, and even jet fuel supply at airports. Unplanned interruption of natural gas service to homes and businesses during the winter heating season can be particularly disruptive and even threaten personal safety, during extremely low temperatures.

The potential consequences of gas transmission pipeline releases vary primarily due to the characteristics of the surrounding area. Gas transmission pipelines transport natural gas almost exclusively. Natural gas releases pose a primarily acute hazard. If an ignition source exists, a release of gas can result in an immediate fire or explosion near the point of the release. The potential for ignition, however, is reduced over a relatively short period as the gas disperses. If the vapors accumulate inside a building, then the hazard may remain longer. There is also a possibility that the size or movement of the vapor cloud could result in consequences away from the initial point of the release, but because natural gas is lighter than air, this situation occurs rarely. Even so, natural gas has been known to travel underground along migration pathways such as sewer lines, finding an ignition source some distance from the location of the release. Other structures and topographic features in the vicinity of a release can serve as barriers and mitigate the consequences of the release for other nearby areas.

Hazardous liquid pipelines transport a great variety of products (including crude oil, petroleum products, natural gas liquids, anhydrous ammonia, and carbon dioxide), so the risks of hazardous liquid pipeline releases vary both according to the commodity involved as well as due to the characteristics of the surrounding area. Releases of some commodities transported in hazardous liquid pipelines, such as propane, pose primarily an acute hazard of fire or explosion, similar to natural gas. These commodities have a high vapor pressure and are in liquid form while transported under pressure in a pipeline. However, if they are released from the pipeline, they will convert to gas as the pressure is reduced. Some of these commodities have densities greater than air, so they are more likely to remain near the ground than natural gas, which disperses more readily.

Releases of other hazardous liquids, such as gasoline and crude oil, have both acute and more long-term potential consequences, as the released product can spread over land and water, flowing into valleys, ravines, and waterways. This can result in harmful consequences to people and to the environment, including human injuries or fatalities from fire or explosion, as well as potential ecological damage and contamination of drinking water supplies occurring some distance from the point of initial release. Figure 7 below shows a gradually decreasing trend in the overall number of pipeline incidents resulting in death or major injury.

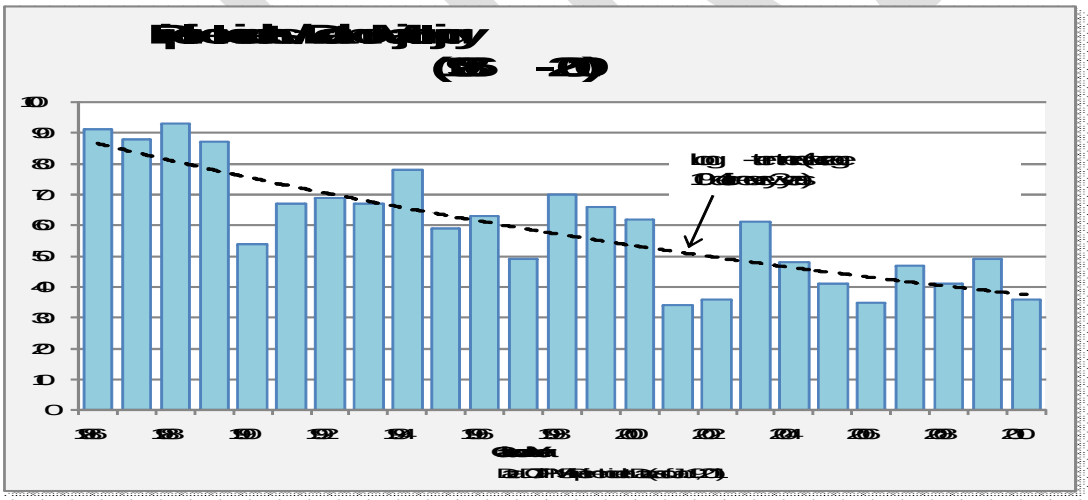


Figure 7 Pipeline Incidents Causing Death or Major Injury

If we examine recent trends in serious pipeline incidents in each of the three major industry segments[8] (see Figure 8) we observe a general if slow and erratic downward trend. (Note OPS defines a serious pipeline incident as an incident causing a fatality or an injury requiring in-patient hospitalization). The significantly higher number of serious incidents for distribution pipelines can best be understood by noting there are nearly seven times as many miles of distribution pipeline as gas transmission pipeline and over twelve times as many miles of distribution pipeline as hazardous liquid transmission pipeline. Additionally, distribution pipelines are necessarily located in areas where people live and where excavation activity (with its potential to damage the pipeline) is likely much higher. Serious incidents for gas gathering lines are very infrequent, with none occurring in many years.

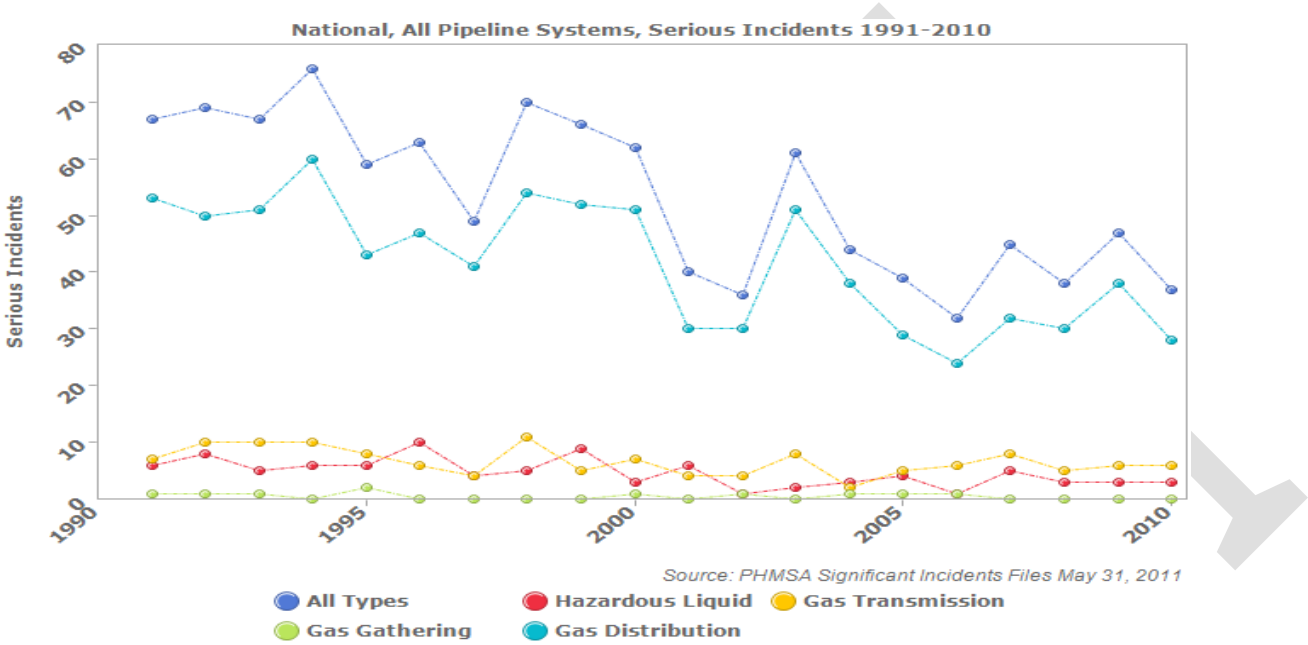


Figure 8 Pipeline Systems Serious Incidents 1991 to 2010

Notes for Figure 8

a) Serious Hazardous Liquid and Gas Transmission offshore incidents are combined with their onshore counterparts in this figure. There have been no serious offshore Hazardous Liquid incidents reported over the displayed time period and no serious offshore Gas Transmission incidents since 1996.
b) Gas Distribution incidents where fire/explosion was the primary cause of failure, such as a house fire that subsequently resulted in - but was not caused by - a distribution line failure are excluded from 2004 onward. This exclusion has not been applied in years prior to 2004 due to difficulty in identifying these types of events with the older report formats. This data treatment does not significantly affect the overall trend in the number of gas distribution incidents over this period.

To put this information in perspective, Figure 9 below presents the same data but presents the serious incidents per thousand miles of pipe. When the mileage effects are taken out, the serious incident per thousand miles are quite similar for the three industry segments.

[8] See PHMSA Stakeholder Communication web site http://primis.phmsa.dot.gov/comm/reports/safety/SerPSI.html?nocache=8991

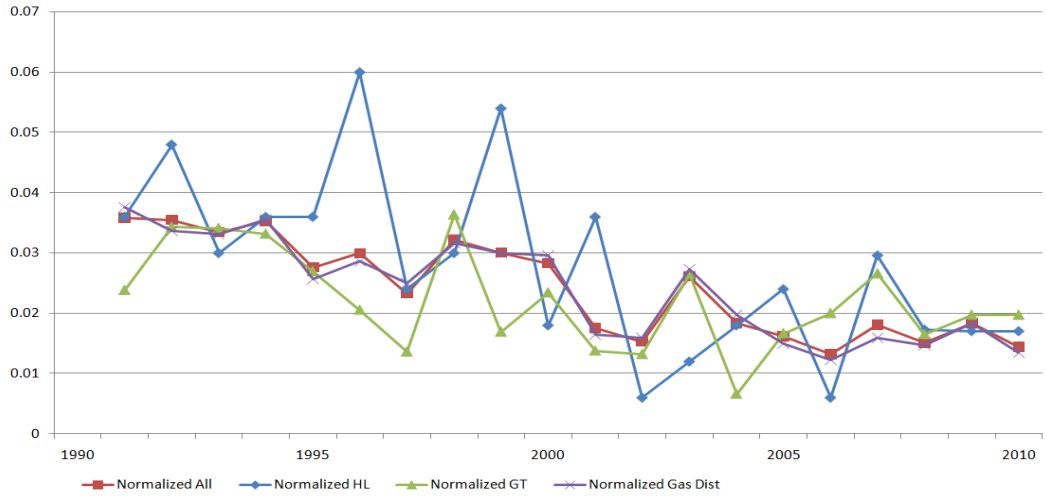


Figure 9 Pipeline Systems Serious Incidents per thousand miles - 1991 to 2010

How do pipeline risks compare with those associated with competing transportation technologies?

Carrying out a meaningful comparison of the level of public risk associated with various modes of transporting natural gas and petroleum products is very difficult. For natural gas, there really are no alternatives to the current pipeline transportation and delivery system, so data on risks associated with alternatives do not exist. Petroleum products on the other hand are currently shipped by several major transportation modes. Data assembled by the Association of Oil Pipelines (AOPL) for 2008 show the following percentages (measured in Ton-Miles) shipped: pipelines (71.4%), water carriers (22.0%), motor carriers (4.0), and railroads (2.6%). So data are available on the quantities of petroleum products shipped.

The difficulty in estimating relative risk arises in trying to determine the number of accidents and accident severity for modes other than pipelines. Data are available for accidents related to shipment of hazardous materials by truck, rail and barge, but are not easily separated by the type of hazardous material being shipped. Additionally, the reporting of accidents for transportation modes other than pipelines uses different criteria on level of severity than pipeline accident reporting, and normalizing out the effect of the distances traversed in transporting hazardous materials is nearly impossible.

As part of the Pipelines and Informed Planning Alliance (PIPA) initiative, OPS attempted to evaluate the relative risk of various transportation modes in the context of local planning decisions. The results of this study may be found at http://primis.phmsa.dot.gov/comm/publications/PIPA/PIPA-PipelineRiskReport-Final-20101021.pdf OPS' study concluded that comparison of risks between transportation modes is very difficult, in part because differences in the reporting criteria of serious incidents between pipelines and other modes. For example, if road and railway serious incident counts include injuries not requiring hospitalization, then hazardous liquid and gas transmission pipelines have had lower rates of serious incidents per mile than those other transportation modes, but if road and railway serious incident counts instead include injuries requiring hospitalization, then transmission pipelines have had lower rates of serious incidents than railways, but higher rates than road transportation of hazardous materials. The caveats on these conclusions in the PIPA risk report underline the need for far better incident reporting if a meaningful risk comparison among petroleum transportation modes is to be developed.

Comparative Environmental Performance

When released from pipelines, petroleum and related products will likely harm the environment. The spills near Marshall Michigan in 2010, most of which flowed into Tallmadge Creek and the Kalamazoo River, and the one into the Yellowstone River in Montana in 2011have underlined the potential for environmental damage from uncontained spills.

In evaluating relative pipeline environmental impact, the first question is whether pipelines represent the most environmentally benign way to transport petroleum materials. If the results from a recent API study on U.S. oil spillage[9] are combined with the AOPL Annual Report on Shifts in Petroleum Transportation[10] the table below results.

Table 1 Comparison of Petroleum Spills by Transportation Mode

Transportation Mode	Estimated Annual U.S. Oil Spillage (bbl) (1998-2007)	Percent of Total Oil Spillage (1998-2007)	Percent of Material Shipped (Ton-Miles)
Inland Pipelines	76,754	79.6	67.0
Tanker Trucks	9,181	9.5	3.6
Tank Ships & Barges	9,027	9.4	27.0
Railroads	1,431	1.5	2.4
Total	96,393	100.0	100.0

Table 1 indicates that pipelines spill less material in proportion to that shipped than do tanker trucks, but spill more material in proportion to that shipped than do tank ships & barges.

The second question relates to whether pipeline spill trends are increasing or decreasing. Figures 10 and 11 below were developed from accident data reported to OPS by hazardous liquid operators. The figures show the trend in significant accidents[11] per thousand miles of pipeline and volume of material spilled in accidents per thousand miles over 2004-2009. These charts were developed for accidents involving line pipe only and do not include accidents at facilities such as pump stations and tank facilities, because this is where pipeline accidents are most likely to have an impact on the public.

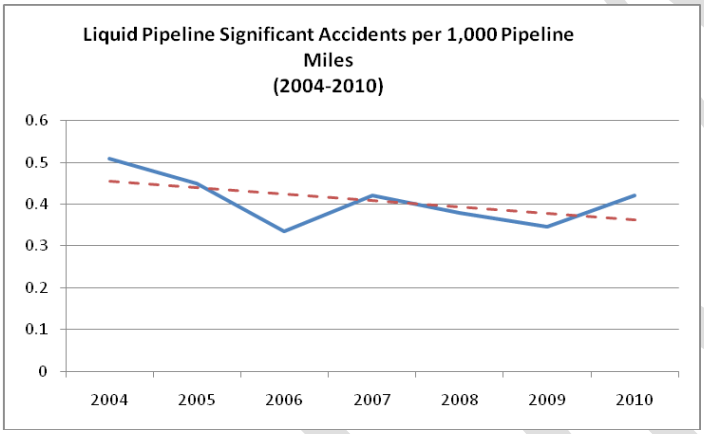


Figure 10 Number of Spills per 1,000 miles

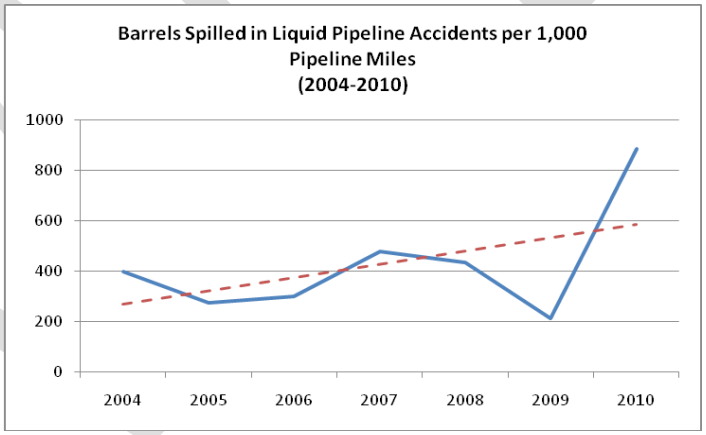


Figure 11 Barrels released per 1,000 miles (1 barrel is 42 gallons)

While the number of spills has gradually trended downward since 2004, the very severe spill near Marshall, Michigan in 2010 has, single handedly caused the previous level to slightly downward trend in volume spilled to turn upward.

Factors Affecting Pipeline Safety

Incident Causes

[9] "Analysis of U.S. Oil Spillage", API Publication 356, August 2009.

[10] "Annual Report on Shifts in Petroleum Transportation", Association of Oil Pipelines, January 2011.

[11] OPS defines "Significant Incidents" as those incidents reported by pipeline operators when any of the following specifically defined consequences occur: fatality or injury requiring in-patient hospitalization; $50,000 or more in total costs, measured in 1984 dollars; highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; liquid releases resulting in an unintentional fire or explosion

Pipeline incident causes fall into several broad categories based on how OPS collects incident data from pipeline operators. Figures 12 and 13 below show the number and percentage of significant onshore hazardous liquid and gas transmission pipeline incidents attributable to different cause categories during 2006-2010. Only incidents involving line pipe are included (pipeline facilities such as pump or compressor stations or tank facilities are not included). For both hazardous liquid and gas transmission pipelines, the predominant failure causes for line pipe are corrosion, material/weld failures, and excavation damage.

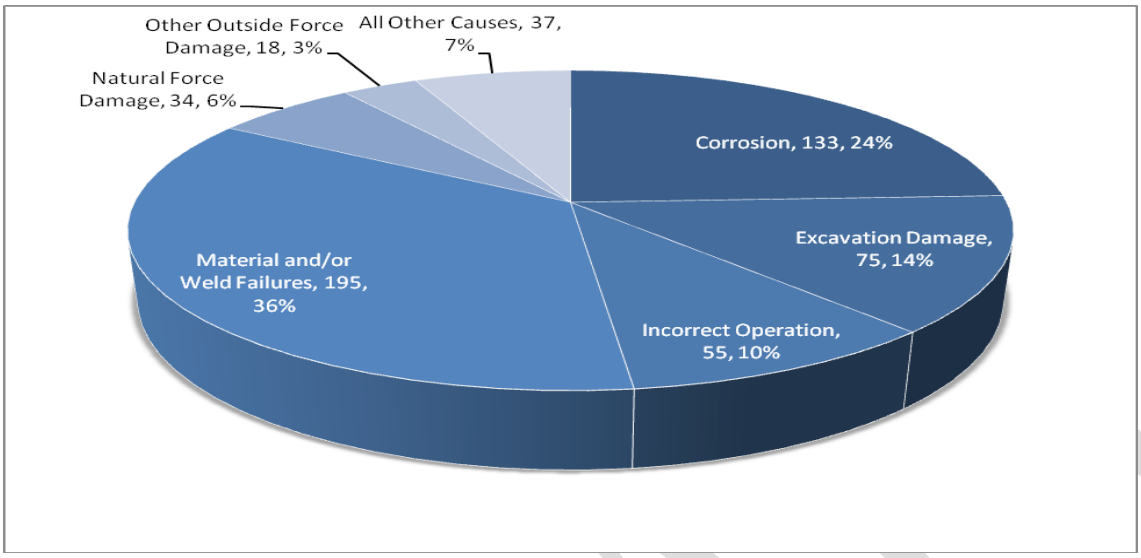


Figure 12 Causes of Significant Onshore Hazardous Liquid Pipeline Incidents
(Right-of-Way Line Pipe Only 2006-2010)

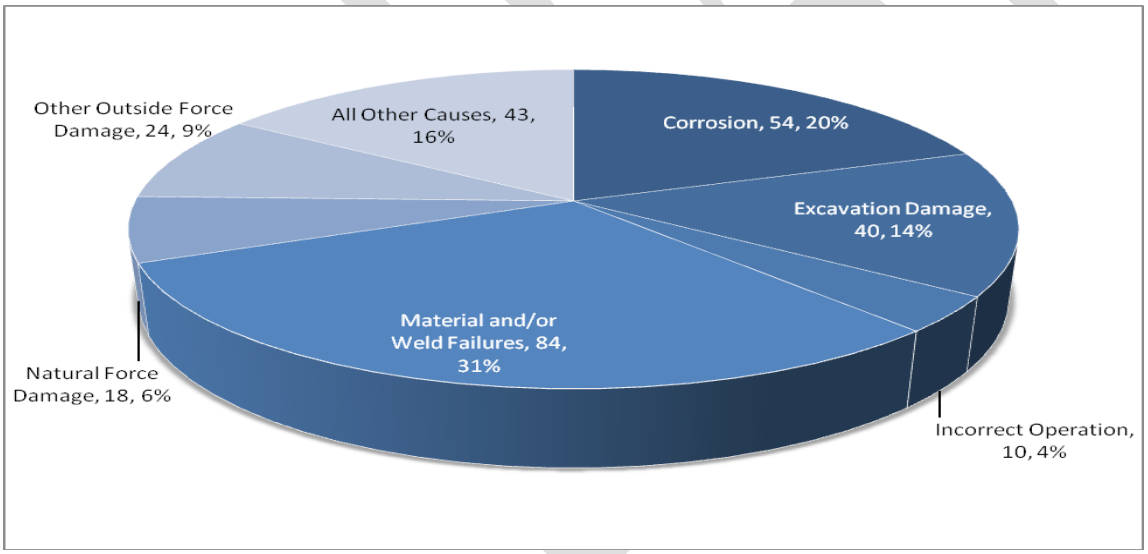


Figure 13 Causes of Gas Transmission Pipeline Significant Onshore Incidents
(Right-of-Way Line Pipe Only 2006-2010)

Gas Distribution Incidents

The breakdown of significant incidents by the threats that caused them discussed in this section has been taken from the OPS Stakeholder Communication Web Site. The data to develop these figures is for the five-year period from 2006 to 2010. http://primis.phmsa.dot.gov/comm/reports/safety/SigPSIDet_2006_2010_US.html?nocache=680#ngdistrib

Figure 14 below shows that for U.S. distribution pipeline systems, the most significant individual cause categories for significant incidents are excavation damage, other outside force damage, and other unspecified causes. The major contributor to the other outside force damage is damage by a vehicle not engaged in excavation.

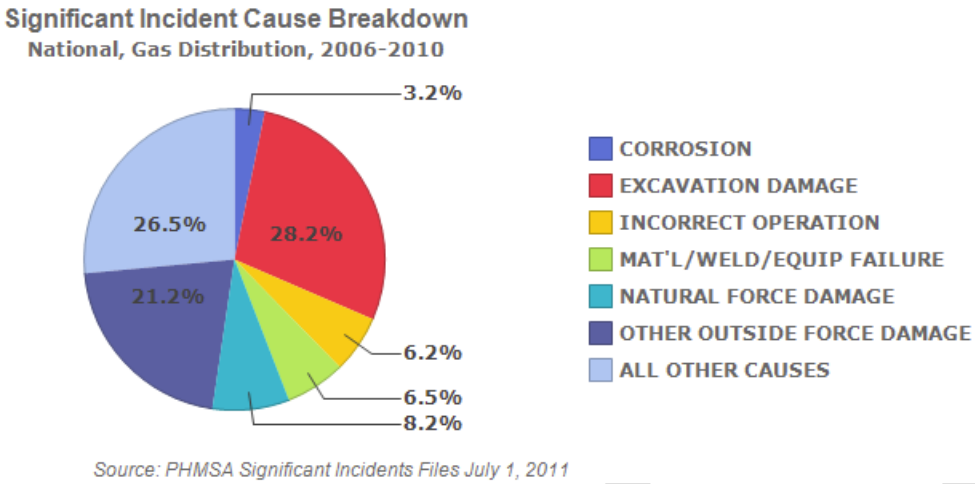


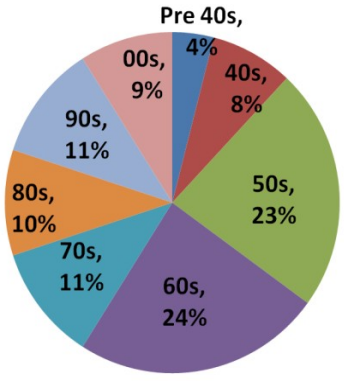
Figure 14 Significant Distribution System Incidents by Cause (2006 – 2010)

Gas Distribution Leaks

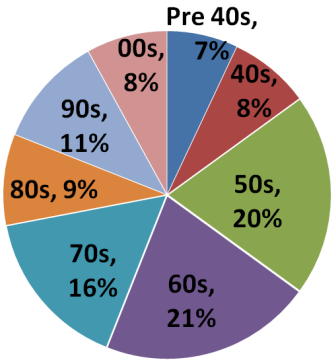
As discussed in Section 4, gas distribution systems occasionally have leaks. The approach distribution operators take to ensure these leaks do not lead to incidents is to conduct periodic leak surveys and remove or repair leaks above a certain threshold. While different operators have different philosophies regarding whether all leaks are eliminated and exactly how leaks removed are reported, it is illustrative to consider the typical number of leaks removed from distribution systems annually. Reported data on leaks removed or repaired in 2009 indicate there were 0.12 per mile of mains (about one leak for every eight miles of main), and 0.47 per mile of service lines (about one leak for every two miles of service line). Reporting inconsistencies make trending these eliminated leaks at a national level meaningless.

How old is the nation's pipeline infrastructure?

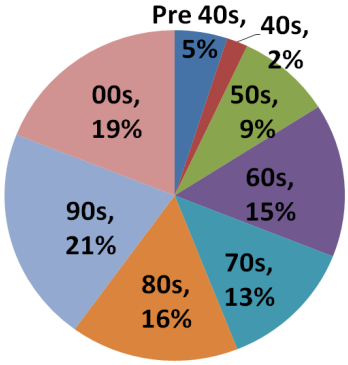
Much of the nation's pipe has been in the ground for a long time. Over 50% of the nation's pipelines were constructed in the 1950's and 1960's during the creation of the interstate pipeline network built in response to the huge demand for energy in the thriving post-World War II economy. Some pipelines were built even earlier. Approximately 3% of our gas distribution mains are made of cast or wrought iron and were built in the first half of the 20th century. Over 12% of the nation's cross-country gas transmission and hazardous liquid pipelines were built prior to the 1950's. Each of these types of pipelines has its own unique age (and material) distribution. The following charts depict the percentage of pipelines constructed by decade (50s = 1950's) for each of the three types of regulated pipelines.



Gas Transmission and Gathering



Hazardous Liquid



Gas Distribution

Figure 15 Pipeline Age Distribution for Transmission and Distribution Pipelines

Is pipeline age a factor in its safety?

One of the issues receiving significant attention is the effect of aging on the integrity of a pipeline. It is true that a significant fraction of the pipeline infrastructure currently in service was installed prior to 1980:

- Gas transmission 59% prior to 1970 and 69% prior to 1980;
- Hazardous liquid transmission 55% prior to 1970 and 71% prior to 1980;
- Gas distribution 31% prior to 1970 and 44% prior to 1980.

Some early vintage pipelines have shown higher failure rates from certain causes than later vintage pipelines. This is believed to be attributable to manufacturing, construction, operating, and maintenance practices in effect at the time that these pipelines were installed, rather than the age of the pipelines. Operators that apply integrity management practices to older pipelines - including pressure testing, records validation, and in-line-inspection - are able to achieve safety performance as good as newer pipelines. However, more analysis is needed to reach definitive conclusions on the effectiveness of integrity management practices in dealing with the risks associated with aging pipelines.

What standards were used for older pipelines?

The first federal pipeline safety regulations were put in place for gas pipelines in 1968 and were based on the standard adopted by most states, the American Society of Mechanical Engineers publication ASME B31.8 - Gas Transmission & Distribution Piping Systems. Soon thereafter, similar regulations were added covering hazardous liquid pipelines, based on ASME B31.4 - Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids. Prior to these rules, operating companies generally used the accepted industry standards for pipe materials, manufacturing, construction, testing, and operation that were considered state-of-the-art at the time of installation. Pipeline materials, corrosion protection methods, and construction technologies and standards changed and by and large improved over time. For example, modern coating materials for steel pipe has greatly improved over those used decades ago, and in the very early decades of construction, no coating was used at all. In addition, pipe welding, inspection and testing techniques have evolved. Many of the welding techniques used earlier have been phased out and replaced by newer, more reliable, and more effective techniques. That means that some of our current pipeline infrastructure was built using materials and welding techniques that - though considered acceptable and state-of-the-art at the time - are no longer used today for new construction.

How safe are older pipelines?

There are at least three interrelated factors involved in evaluating the safety of older pipelines: the standards to which they were designed, the operator's knowledge of their design and physical condition, and the integrity programs under which they are maintained and repaired. Recent accidents in San Bruno, California and Allentown, Pennsylvania have raised questions about the operator's knowledge of the design and physical condition of older pipelines. The threats that most directly relate to aging are time-dependent threats like corrosion, stress corrosion cracking, earth movement or settlement and cyclic fatigue. Like any long-lived asset, pipelines must be managed and maintained in the light of factors such as the type of pipe, its construction and its service history, and the impact of time dependent threats. OPS continues to evaluate the causes and characteristics of pipeline failures to determine how future incidents can be prevented. Determining how best to evaluate fitness for service as part of an integrity management program will be a basic element of ensuring the safety of older pipeline.

4. **Challenges and Ongoing Initiatives**

- **Improving pipeline safety requires that industry and regulators focus their energy and resources on understanding and managing a set of known risks.**
- **To drive accidents and safety impacts to zero, pipeline operators and regulators must address a broad array of factors that contribute to current incidents.**
- **Lessons from operating experience across the industry are one of the best sources of information to improve safety performance.**
- **Many recognized key safety issues are already being addressed through established programs such as integrity management regulations and high-risk pipe replacement programs; programmatic improvements and accelerated pipe replacement actions may be required to meaningfully improve pipeline safety.**
- **Much is currently being done to improve pipeline safety. Many new programs and requirements are not yet mature, so the benefits have yet to be fully realized.**

Pipeline safety has been a concern since the first distribution lines were installed nearly 200 years ago. Federal regulation of pipeline safety began in 1970. Initial regulations were based on the current version of national consensus standards first published in 1928. Since the late 1990s the pipeline regulatory community and the operators they oversee have been formally focused on managing the risks associated with pipelines. The term risk describes the combination of the frequency with which incidents occur and the consequences associated with their occurrence. Risks to the public from hazardous liquid and gas pipelines result from the unintentional release of products transported through the pipelines. Releases of products carried by pipelines may result in injuries or fatalities as well as property and environmental damage.

The pipeline industry has a stated goal of zero incidents. However, recent incidents causing numerous deaths and significant property damage have reemphasized the need to figure out how to limit the consequences of incidents as well. Working toward achieving the goal of zero incidents will require that operators understand the sources of risk and work on the highest risk issues first. Assuring compliance with Federal and state safety regulations provides the baseline program for getting to zero incidents. However, pipeline operators must also design and construct new systems to the highest quality standards; assure the fitness for service of their existing systems; support development and demonstration of new safety technologies; be aware of, develop and deploy new technologies to improve the integrity of their pipeline systems; establish and maintain a strong organizational culture supporting safety as the overriding corporate goal; assure corporate safety budgets are sufficient to deal effectively with known risks; work to anticipate emerging risks and deal with them before they lead to incidents; interact effectively with rate regulators to assure sufficient capital and operating funds are approved; and aggressively support ever-improving actions to prevent excavation damage to existing pipelines. This is a formidable list of activities all of which are essential for getting to zero incidents.

Regulators also have a significant role in moving toward zero incidents. Even very responsible, committed and forward looking operators can benefit from effective regulation. Beyond assuring that safety regulations drive the most effective baseline safety program, focused regulatory oversight will benefit pipeline safety by: establishing requirements that reinforce appropriate resource expenditures by operators; assuring that inspection and enforcement actions are improving safety by driving the best safety solutions; assembling and analyzing safety performance data across the industry and communicating lessons to operators for their action; expanding the knowledge on how to improve safety through technical studies and research, development and demonstration of new technologies; and developing means, possibly including new regulations, for improving awareness and involvement of the affected public. Finally, both regulators and operators need to examine and develop economically viability means to mitigate the consequences of incidents.

An operator's overall safety management effort can be thought of as a combination of integrity management, management of compliance with other safety regulations and a management of variety of additional activities not explicitly required by regulation but important to achieving continuing safe operation. This section together with Appendix 10 summarizes some of the many challenges that must be addressed by operators and regulators alike to successfully manage pipeline safety. It also describes actions already underway to address these challenges. Figure 16 below describes the content of the challenges and ongoing initiatives section. This Section introduces the subject by describing integrity management

programs. Additional details on challenges and initiatives can be found in Appendix 10. Ideas on new initiatives to further improve pipeline safety are explored in Section 5.

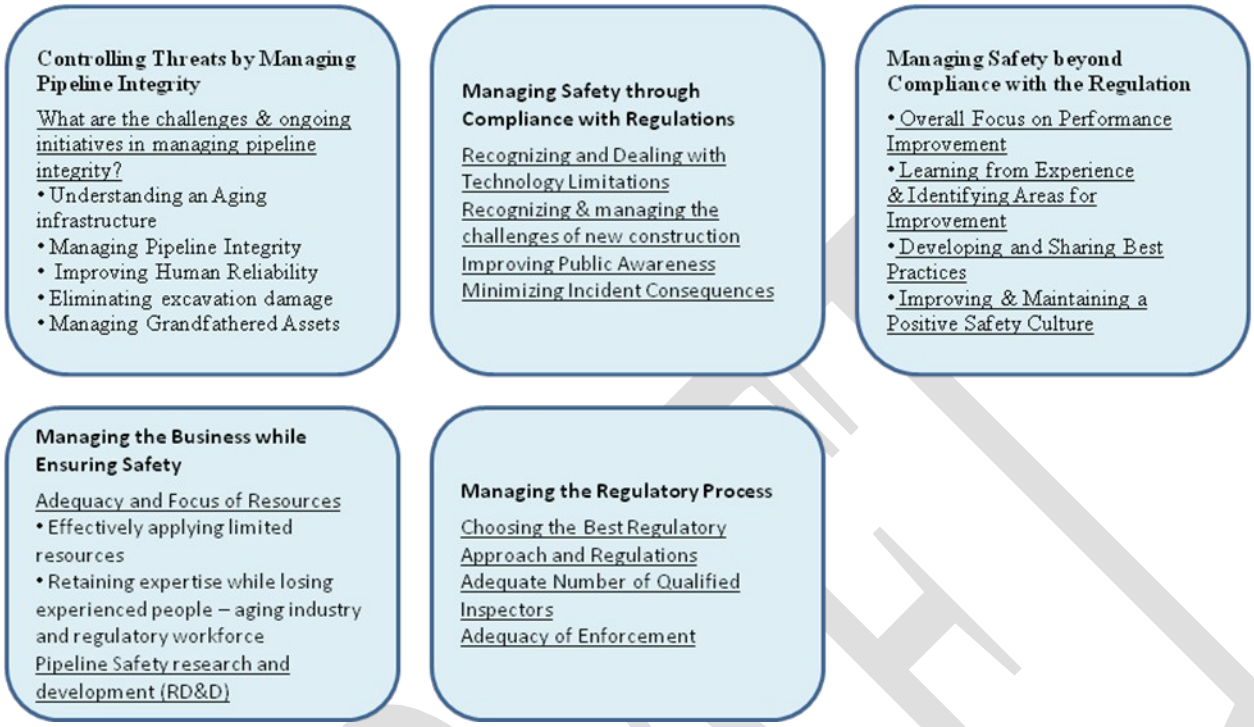


Figure 16 Content of Discussion in Appendix 10 on Challenges and Ongoing Initiatives

What is integrity management?

Integrity management program (IMP) regulations have been in place for large cross-country pipelines since 2000 (liquids) and 2003 (gas). As of August 2011 integrity management programs are also required for gas distribution pipeline systems. The scope of these programs is somewhat different. Only pipe in high consequence areas (population-based areas for both gas and hazardous liquid pipelines, and - for hazardous liquid pipelines - an area of unusually sensitive ecology or drinking water supply or a commercially navigable waterway) are covered by the regulations for gas and hazardous liquid cross-country pipelines; while the entire system is covered for distribution pipeline systems.

Effective management of pipeline integrity requires first and foremost that an operator clearly understand the characteristics of the infrastructure it manages and the impact of these characteristics on the risk of various parts of its system. A significant fraction of the current infrastructure was constructed before formal requirements existed to retain comprehensive information on pipe and coating characteristic. Therefore, developing a comprehensive understanding of their systems represents a significant challenge to operators. IMP regulations require operators to assemble and integrate this information as part of understanding the risk of their pipeline systems. Other major integrity management requirements for cross-country pipelines include periodic assessing the physical condition of the covered pipe, repairing defects that meet certain criteria, and evaluating the need for additional preventive and mitigative measures to better manage system risk.

Leak Management in Distribution Pipeline Systems - Unlike large diameter high pressure cross-country pipelines, leaks in the small lower pressure pipelines in distribution systems must not all be eliminated. A fundamental part of the safety management approach of distribution pipeline operators is management of those leaks to prevent safety consequences. Leak management includes many elements – two of which are odorization of the gas so customers can detect and respond to a gas leak in their residences, and periodic leak surveys by the operator to identify leaks that need to be monitored or removed. The characteristics of an effective leak management program are described in the distribution IMP regulation.

Gas distribution pipeline systems are typically not designed to allow integrity assessment by the same technologies used for cross-country pipelines. Therefore integrity management

requirements for distribution systems are different. In addition to requiring assembly and integration of data on factors potentially affecting pipeline integrity and use of this data to characterize the risk, distribution operators are required to implement a prescribed leak management program and to use experience data to evaluate where additional and accelerated actions, such as more frequent leak surveys and replacement of higher risk pipe, are needed.

Safety is Expected to Improve as Existing Initiatives Mature

OPS, its state partners, the industry and their trade associations have all been heavily involved in efforts to improve pipeline safety. The past dozen years have produced the most significant changes to means to improve pipeline safety since federal pipeline regulation was begun around 1970. As problems are recognized, new regulations and initiatives have been developed at an unprecedented rate. One caveat that we should offer on this enormous rate of change to our collective approach to pipeline safety is that new initiatives often require significant time to produce the concrete safety benefits they were designed to achieve. As an example, many of the recently passed regulations have yet to complete their first cycle of implementation. Examples of this phenomenon include:

- The initial cycle of assessment and repair of pipeline covered by the hazardous liquid integrity management program regulation was only completed in March 2007; we have yet to assemble sufficient data to determine whether the rate at which we find and fix defects considered severe enough to be repaired immediately is significantly lower in the second assessment cycle.
- The initial cycle of assessment and repair of pipeline covered by the gas pipeline integrity management program regulation will not be completed until December 2012; the effect of completed assessment and repair on incident rate cannot yet be evaluated.
- In-line inspection technology continues to improve, allowing operators to observe and characterize smaller and smaller defects.
- Although the deadline for implementation of the gas distribution integrity management program regulation is August 2011; it will be many years before we are able to understand the impact of this management system-focused regulation on the incident rate in distribution pipelines.
- The operator qualification regulation went into effect in December 2004; while the performance of those covered by its provisions should have improved, at least one important area, individuals involved in new construction, were not covered in the initial regulation.
- The control room management regulation will go into effect in August 2011; its impact will probably not be observable in incident data for several years.

Many key safety management regulations that will drive considerable improvement in pipeline safety performance for years to come have already put in place. The danger in pursuing too many additional initiatives is that the attention of regulatory and operator management will be sufficiently diluted that establishing mature programs supporting future safety performance improvements derived from existing initiatives could be compromised. For that reason Section 6 is titled “Ideas for New Initiatives”, deferring a final commitment on which will be pursued until their importance has been carefully evaluated in the light of ongoing commitments to existing initiatives.

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5. Ideas for New Initiatives

- **Continued improvement of regulations, oversight, management practices, safety technology and vigilance, both by the operators and by other key stakeholders, will be needed to drive accidents and injuries to zero.**
- **There are important roles for all key stakeholders in continuing to improve pipeline safety. Private/Public partnerships should play an increasingly important role.**

This Section is titled "ideas for new initiatives" rather than "commitments to new initiatives" for a good reason – there are many initiatives already in progress, many of which are just beginning and none of which has reached a level of maturity to allow its ultimate impact on pipeline safety performance to be evaluated. These ongoing initiatives are consuming significant regulatory and industry resources, including management attention, and diluting the current focus on these initiatives by committing to a large set of new initiatives could easily have the opposite effect on performance than doing nothing more. Nevertheless, many very good idea on how to improve pipeline safety have been discussed at the April 2011 Pipeline Safety Forum and submitted afterwards in response to the Secretary's invitation. These ideas deserve careful consideration, and the most promising should certainly be undertaken.

The intent of this section is to describe potentially promising ideas on how to improve pipeline safety; to identify which stakeholder groups should take the lead in considering their merits and determining how to proceed; and to ask each stakeholder group to commit to report back on their decisions, plans and actions to address the most promising ideas by October 30, 2012. OPS' Technical Safety Advisory Committees (TAC) will be asked to assume the additional responsibility of reviewing and evaluating the progress reports from stakeholder groups and recommending further action.

Ideas for improving pipeline safety have been organized into the following categories:

- Overall Safety Improvement Initiatives
- Monitor the Effectiveness of and Strengthen Recent Regulatory & Other Initiatives
- Increase the Effectiveness of Lessons Learned Processes
- Strengthen Public Communications
- Continue and Expand Research, Development and Demonstration
- Evaluate the Effectiveness of Agency & Inter-Agency Regulatory Oversight
- Identify Means to Strengthen People Resources

Individual ideas for pipeline safety improvement are described under each category and Table 2 summarizes the organizations requested to commit to evaluate and plan actions related to each.

Overall Safety Improvement Initiatives

Fitness for Service - The concept of fitness for service has been widely discussed during and following the Pipeline Safety Forum. It will be an important complement to integrity management only when key stakeholders have agreed to its definition and appropriate changes to regulations have been made.

Safety Strategic Planning - Presently safety planning by regulatory bodies is often driven by responses to incidents. Too often operator safety strategic planning is also reactive to regulatory initiatives such as Safety Advisory Bulletins and new regulations. An integrated forward-looking safety strategic planning process involving major stakeholders seems to have value. OPS' TACs, which include high-level representatives from major pipeline safety stakeholder groups, are a strong candidate to lead such a forward-looking strategic planning process.

Joint Industry-Regulator Data Evaluation - Data reported to OPS and the states by pipeline operators represents a fertile source of insights into safety issues and trends. Understanding the quality and subtleties of these data requires more than just number-crunching, especially when reported data are used to evaluate individual operator performance. Joint data evaluation has a precedent in the PPDC. Consideration is needed in how to build on that precedent to better understand the implications of currently-reported data and also to identify opportunities for strengthening safety insights by changing

or expanding data reporting requirements, including working toward a process (data collection, analysis & communication) to address leaks and incidents below the current reporting threshold.

Broadening the Reach of Trade Association Safety Initiatives - As described in Section 4 and Appendix 10, the major trade associations are actively engaged, often at the operator executive level, in evaluating opportunities for improving pipeline safety and organizing initiatives to address identified opportunities. These initiatives typically go well beyond what is required by regulation. These initiatives are expected to significantly impact the safety performance of member companies. Evaluating how to broaden that impact beyond member companies should be evaluated. An incident at a non-member operator damages industry reputation as much as an incident at a member company.

Monitor the Effectiveness of and Strengthen Recent Regulatory & Other Initiatives

Evaluate the Effectiveness of Key Regulations - Over the past decade OPS has issued major new requirements designed to improve safety. Examples include integrity management for all industry sectors, operator qualification, and control room management. OPS and its state partners need to continue to inspect operator compliance with these requirements, to evaluate compliance and performance data, and to identify ways to improve the impact of the requirements by clarifying ambiguous aspects, by identify and communicating practices operators have found to be effective, an - as needed - by strengthening or expanding current requirements. Considerations might include expanding IMP requirements by:

- Mandating immediate repairs for defects both in and outside HCAs for all onshore pipelines;
- Expanding IMP requirements to incorporate fitness for service;
- Strengthening leak detection requirements on hazardous liquid lines;
- Updating data supporting HCA determinations for hazardous liquid lines;
- Considering expansion of HCA definition for gas transmission pipelines, or determine how to apply IMP principles across the entire transmission pipeline system.

Strengthen Excavation Damage Prevention Programs - While much is being bone to reduce excavation damage to pipelines, including new enforcement initiatives, continued attention to performance trends and causes is needed. This continued attention should include: continuing efforts to strengthen excavation damage prevention initiatives (especially CGA, PIPA and 811); monitoring the effectiveness of current initiatives, including through emphasis on capturing, tracking & trending of data on events with less severe consequences such as distribution pipeline leaks; developing and communicating model state a damage prevention law; and identifying and implementing practices for states to evaluate the effectiveness of their own damage prevention programs.

Act on New Legislative Authority - Once the new bill has passed, OPS must pursue initiatives mandated by the 2011 pipeline reauthorization, including regulating pipeline infrastructure currently not within its statutory authority.

Consider the Need for Expanded Regulation - In addition to its need to act on any new jurisdiction the 2011 pipeline reauthorization provides, OPS should continue to investigate the value to pipeline safety of new requirements, including: effective quality management applied to all construction and operations and maintenance activities; strengthened requirements on natural force threats such as earthquakes, hurricanes, flooding; pipeline construction standards, especially pipe bedding, backfill and compaction criteria; and Emergency Response Plans.

Increase the Effectiveness of Lessons Learned Processes

Continue and Expand Incident Cause Analysis and Communication of Implications - Insights from incident investigations continue to be fertile ground for learning about and improving pipeline safety. OPS, the states and operators all need to improve the quality of their evaluation of underlying causes of events considered significant either because of their consequences or other unique characteristics. OPS needs to continue its aggressive development of Advisory Bulletins based on lessons from incidents, as well as to identify means to evaluate operator responsiveness to bulletins; OPS should also consider the value of publishing operator responsiveness results on a public website.

Evaluate What More can be done with Information Sharing - Means to more effective share knowledge across industry should be explored, including: industry partnering with OPS on open and timely knowledge sharing with industry, especially that derived from investigation of incidents; establishing data quality teams involving government, industry, and the public to improve data collection and analysis; evaluating and improving processes for sharing inspection and enforcement practices among federal and state regulators.

Strengthen Public Communications

Expand upon Existing Information Sharing Processes - All parties to pipeline safety have a stake in improved communication. Regulators need to demonstrate their effectiveness in driving safety improvements; operators want to build trust relationships with communities in which their pipeline systems reside, in part so they are allowed to expand their systems when the need arises; the public wants to understand both the benefits and the risks of living near pipelines, as well as how they should respond to incidents. Ideas presented foir how to strengthen communications include:

- Strengthen the Public Awareness standard, API Recommended Practice 1162, and incorporate its provisions in regulation;
- Continue to educate all stakeholders on the importance of energy and the role of pipelines in its delivery;
- Encourage operators to promote a higher level of cooperation with emergency responders;
- Balance the needs for data security and accessibility; strike a balance between the "right to know" and "need to know";
- Expand stakeholder website (e.g., by publishing operator responsiveness to safety advisory bulletins);
- Aggressively promote practices described in the PIPA report;
- Increase transparency of state programs and data;
- Communicating effective practices in funding high risk pipe replacement programs among rate regulators.

Continue and Expand Research, Development and Demonstration

Expand Funding and Focus of RD&D Programs - Proven new technology will continue to be an important driver for improving pipeline safety. As economic conditions shrink available resources, more effective use of existing funds and new sources of funding are needed. Mechanisms are needed to fairly and equitably assess charges for RD&D. Examples of areas where new technology might significantly improve pipeline safety include:

- Better assessment tools and improved data integration;
- Better hazardous liquid pipeline leak detection technology;
- Improved means of mitigating the consequences of incidents like less costly more reliable remote shut-off capability.

In addition, continued and expanded communication among pipeline groups funding R&D will help ensure efficient pursuit of the shared objective of improving pipeline safety.

Evaluate the Effectiveness of Agency & Inter-Agency Regulatory Oversight

Reevaluate the Effectiveness of Enforcement Practices - Congress continues to increase the size of fines OPS can impose on operators. The implicit assumption is that some operators will only comply with safety requirements if it makes economic sense to do so. However, larger fines may lead to a more contentious enforcement, with the possibility that inspectors will seek other less confrontational means to promote compliance. OPS and the states need to better understand the relationship between enforcement practices and the impact on operator's seeking to implement the best approach to achieving safety. Further evaluation is needed on how regulators can best promote not only compliance, but also operator behavior consistent with achieving improved safety. This evaluation needs to consider the implications of enforcing the new set of performance-based regulations, such as IMP and operator qualification.

Strengthening the Relationship Among Regulators - As discussed in Section 2 and Appendix 9, OPS and its state partners interface with a number of other regulatory bodies. These relationships need periodically to be reexamined and clarified or changed. Examples of areas that might be strengthened include:

- Revise Memoranda of Understanding (MOUs) to eliminate conflicting or overlapping jurisdiction (e.g., FERC, EPA, BOEMRE and USCG);
- Explore ways that the federal government might assist states in dealing with at risk pipe to accelerate their repair, rehabilitation, replacement, or requalification; means might include "predictive service life models" for consistently characterizing level of risk;
- Connect siting and rate setting decisions made by FERC and states rate regulators with safety;
- Encourage public service commissioners to meet regularly with their pipeline safety teams and staff to discuss pressing issues and candidate solutions; publish schedules and results for public view;
- Strengthen processes for public involvement in safety discussions.

Identify Means to Strengthen People Resources

Ensure Strong Pipeline Staff and Managers - Ensuring that pipeline regulators, workers and managers have the knowledge and experience to safely manage the nation's pipeline systems is important. Issues that need to be addressed include: how to entice younger employees into the industry; how to ensure state inspector workforce strength and stability.

Table 2 Summary of Ideas for Improvement and Organizational Lead Responsibilities for Investigating

Improvement Idea	OPS	State Safety Regulator (or NAPSR)	State Rate Regulator (or NARUC)	Industry Trade Associations	Technical Advisory Committees (TAC)
Overall Safety Improvement Initiatives	➢ *Fitness for Service*			➢ *Joint Industry-Regulator Data Evaluation* ➢ *Broadening the Reach of Trade Association Safety Initiative*	➢ *Safety Strategic Planning*
Monitor the Effectiveness of and Strengthen Recent Regulatory & Other Initiatives	➢ *Evaluate the Effectiveness of Key Regulations* ➢ *Act on New Legislative Authority* ➢ *Consider the Need for Expanded Regulation*	➢ *Strengthen Excavation Damage Prevention Programs*			

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Improvement Idea	OPS	State Safety Regulator (or NAPSR)	State Rate Regulator (or NARUC)	Industry Trade Associations	Technical Advisory Committees (TAC)
Increase the Effectiveness of Lessons Learned Processes	➢ *Continue and Expand Incident Cause Analysis and Communication of Implications* ➢ *Evaluate What More can be done with Information Sharing*	➢ *Continue and Expand Incident Cause Analysis and Communication of Implications* ➢ *Evaluate What More can be done with Information Sharing*		➢ *Continue and Expand Incident Cause Analysis and Communication of Implications* ➢ *Evaluate What More can be done with Information Sharing*	
Strengthen Public Communications	➢ *Expand upon Existing Information Sharing Processes*	➢ *Expand upon Existing Information Sharing Processes*	➢ *Expand upon Existing Information Sharing Processes*	➢ *Expand upon Existing Information Sharing Processes*	
Continue and Expand Research, Development and Demonstration	➢ *Expand Funding and Focus of RD&D Programs*			➢ *Expand Funding and Focus of RD&D Programs*	
Evaluate the Effectiveness of Agency & Inter-Agency Regulatory Oversight	➢ *Reevaluate the Effectiveness of Enforcement Practices* ➢ *Strengthening the Relationship Among Regulators*	➢ *Reevaluate the Effectiveness of Enforcement Practices* ➢ *Strengthening the Relationship Among Regulators*	➢ *Strengthening the Relationship Among Regulators*		
Identify Means to Strengthen People Resources	➢ *Ensure Strong Pipeline Staff and Managers*	➢ *Ensure Strong Pipeline Staff and Managers*		➢ *Ensure Strong Pipeline Staff and Managers*	

Acronyms

AGA	American Gas Association
ANPRM	Advanced Notice for Proposed Rulemaking
AOPL	Association of Oil Pipelines
APGA	American Public Gas Association
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BLM	Bureau of Land Management in the Department of the Interior
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
CATS	Community Assistance & Technical Services Teams within the Office of Pipeline Safety
CGA	Common Ground Alliance
CRM	Control Room Management (a regulation)
DHS	Department of Homeland Security

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DIMP	Distribution Integrity Management Program
DOE	Department of Energy
DOI	Department of the Interior's
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESI	Environment and Safety
FERC	Federal Energy Regulatory Commission
FFS	Fitness for Service
GIS	Geographic Information System
HCA	High Consequence Area
IAFC	International Association of Fire Chiefs
IAFF	International Association of Fire Fighters
IMP	Integrity Management Program (a series of regulations)
INGAA	Interstate Natural Gas Association of America
LDC	Local Distribution Company
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAOP	Maximum Allowable Operating Pressure
MOP	Maximum Operating Pressure
NAPSR	National Association of Pipeline Safety Representatives
NARUC	National Association of Regulatory Utility Commissioners
NASFM	National Association of State Fire Marshals
NEB	National Energy Board of Canada
NPGA	National Propane Gas Association
NPMS	National Pipeline Mapping System
NPRM	Notice of Proposed Rulemaking
NRDC	Natural Resources Defense Council
NTSB	National Transportation Safety Board
OIRA	Office of Information and Regulatory Affairs in the Office of Management and Budget
OMB	Office of Management and Budget
OPS	Office of Pipeline Safety
OQ	Operator Qualification (a regulation)
PET	Performance Excellence Team of AOPL
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIPA	Pipelines and Informed Planning Alliance
PIPES	Pipeline Inspection, Protection, Enforcement and Safety Act of 2006
PIX	Pipeline Information eXchange
PPDC	Plastic Pipe Database Committee
PRCI	Pipeline Research Council International
PSC	Public Service Commission
PST	Pipeline Safety Trust
PUC	Public Utility Commission
QMS	Quality Management Systems
R&D	Research and Development
RD&D	Research Development and Demonstration
SCADA	Supervisory Control and Data Acquisition
SGA	Southern Gas Association
USCG	U.S. Coast Guard

Glossary

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Developed Separately

Annotated Bibliography

Developed Separately

Appendices

1. **Pipeline Rate Regulations**
2. **Responses from Survey of States on Cast Iron Replacement Programs**
3. **Fitness for Service**
4. **Pipeline Operator Compliance Programs**
5. **Eliminating Excavation Damage**
6. **How are Cross-Country Pipelines Sited?**
7. **How Regulators are Funded**
8. **State Requirements beyond the Minimum Federal Standards** – Not yet available
9. **Roles of Select Stakeholders in Pipeline Safety**
10. **Additional Challenges and Ongoing Initiatives**
11. **Summary of State Responses to Survey on Staff Size Changes** - from Zach Barrett

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Appendix 1
Pipeline Rate Regulation

Maintaining and improving pipeline safety requires significant expenditure by pipeline operators. The baseline effort involves constructing, operating, maintaining and decommissioning the pipeline system in compliance with state and federal regulations. Additional responsibilities include repairing, replacing, rehabilitating or requalifying pipelines; applying new technologies to better control operations; and monitor the fitness for service[12] of pipelines. The cost of operation and maintenance are typically built into the rates operators are allowed to charge customers for transporting the gas or petroleum products. The complex process for recovering expenditures often makes it difficult for pipeline operators to recover in a competitive and financially regulated environment. If approved by the rate regulator, costs to improve safety may be passed along to the consumers or other users of the hazardous liquids and natural gas through rate cases or other special cost transfer means as discussed below.

In the United States pipelines that transport and distribute natural gas, petroleum, and other hazardous liquids are often regulated as natural monopolies because it is not cost-effective to have more than one pipeline delivery system serving a community. As a result, pipeline operators are sometimes government monopolies, or if privately (i.e., investor) owned, the operating company is generally subject to public rate regulation by entities ranging from local community-based councils and boards to state-wide government agencies like Public Utility Commissions, to federal agencies like the Federal Energy Regulatory Commission (FERC). Ratemaking is the process through which a pipeline operator seeks approval from the operator's regulatory body to recover costs from its customers based on the operator's proposal and the regulator's determination of what constitutes a fair price for the transportation services provided by the pipeline operator.

Ratemaking, which is more art than science, requires the regulator to balance competing objectives and to decide on the appropriate level of rates to be recovered from customers. Ratemaking objectives can include, but are not limited to: 1) setting rates at a level that provides the operator an opportunity to recover the pipeline's cost of service as proposed by the operator and approved by its regulator; 2) encourage economic efficiency to ensure the cost of energy is affordable; and 3) provide an operator the opportunity to earn a return on its investment for shareholders and investors.

Rates for Interstate Transportation of Natural Gas

Most interstate natural gas pipelines are required to provide transportation services to any customer who signs a contract. These pipelines do not own the natural gas being transported and are paid a fee for transportation service by customers, commonly referred to as "shippers." Shippers may pass these costs on to consumers.

The Federal Energy Regulatory Commission (FERC or the Commission) regulates the rates of natural gas transportation across state boundaries. The rates for intrastate transportation of natural gas are usually subject to regulation by state agencies. Competition among pipeline operators sometimes results in an operator discounting its fees and thus recovering less than its allowed cost of service.

Rates for Petroleum and Other Liquid Product Pipelines

Most liquid pipelines are "common carriers" and are required to provide transportation to any customer upon reasonable request. These pipelines do not own the product being transported and are paid a fee for transportation service by its customers. Pipeline operators may pass these costs on to consumers.

The Federal Energy Regulatory Commission (FERC) regulates the rates, terms and conditions of interstate transportation of petroleum and petroleum products by pipeline. In general, the rates, terms and conditions of intrastate transportation of petroleum and petroleum products by pipeline are subject to regulation by state agencies.

[12] As used here fitness for service means the physical condition of the pipeline system is sufficiently robust to avoid incidents at least until the next time it is physically inspected. Developing a more rigorous definition along with possible supporting regulations is suggested as one of the ideas for improving safety in Section 5.

Liquid pipelines have post rates, terms and conditions of service with the FERC. Shippers pay the posted rates to obtain transportation service. Competition among operators sometimes results in an operator recovering less than all of the costs it incurs. Different from other regulated energy industries, liquid pipeline operators are subject to a regulatory framework in which FERC allows rates to be developed by one of several accepted methodologies, including use of a pipeline rate index, typically tied to a published cost index.

Rates for Investor-Owned Local Gas Distribution Companies

Local distribution companies are privately-owned utilities and are required to provide distribution of natural gas to any customer within its geographic franchise area (area where it has a monopoly on shipping gas) upon reasonable request. These utilities own the natural gas being distributed for their "sales customers" and are paid a fee for the distribution service. Local distribution companies don't earn any money from the sale of the natural gas itself, whether the utility owns the natural gas or transports it on behalf of the customer. The companies simply pass the cost of the gas straight through to the consumer. Customers who have purchased their natural gas from a third party supplier or market and wish the distribution company to transport the gas to their business or home, commonly referred to as "transportation customers", pay a fee for the transport of natural gas over the local distribution company's pipeline.

The state public utility commissions (PUC) regulate the rates, terms and conditions of service of natural gas distribution service by investor-owned utilities. In general, the rates, terms and conditions of service of publicly-owned distribution utilities are subject to regulation by local agencies. The PUCs also ensure that gas utilities operate in the public interest. For example, they may prohibit utilities from turning off a residential customer's gas service for nonpayment during cold weather, they may require safety-driven changes beyond those required by the Federal and state safety regulators, or they may require utilities to offer energy conservation programs.

Natural gas utilities post rates, terms and conditions of service with the state commissions. Customers pay the posted rates to obtain the transportation service. Utilities also have information on file with the state commission on the current "purchased gas adjustment (PGA) charge." These charges account for market-driven changes in the price the utility pays for the gas it supplies to customers.

Rate Design for Publicly-Owned Local Gas Utility Systems

Publicly-owned gas systems are non-profit local distribution entities that are owned by and accountable to, the citizens they serve. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies that have natural gas distribution facilities. These utilities own the natural gas being distributed to their customers and charge a fee for the distribution service. In addition, publicly-owned utilities pass through and recover the cost of the natural gas they acquired for their customers.

Unlike privately-owned distribution and transmission pipelines, few publicly-owned gas distribution systems have gas rates set by their state's public utilities commission. Typically rates for a public gas utility are set by its governing body, which may be an elected city or county council or an elected or appointed utility board. There is no requirement that the rate charged by the utility be based on the cost of service, and the utility may charge whatever rate is established by its governing body.

Publicly owned utilities do not include costs for return on investment, or profit in their rates. Necessary capital is raised by issuing bonds, either municipal bonds or revenue bonds. Customers of municipal utilities pay the purchased gas adjustment (PGA) charge for the amount of gas the utility distributes during the billing period. Rate changes must be approved by the city council or the utility board.

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Appendix 2
Responses from March 9, 2011 Survey of States on Cast Iron Replacement Programs

Questions

A. Does your state have cast iron piping in gas service?
B. If yes, has your commission authorized a cast iron piping replacement program?
C. If yes to question B above, what is the rate of replacement per year that has been authorized?
D. What are the special characteristics of the piping being replaced (e.g., small diameter, pressure level, or all cast iron piping?
E. Please provide an estimated year when your cast iron replacement program will be completed
F. Upon completion of the program under D above, will all cast iron piping have been replaced in your state?
G. If the answer to F above is No, in what year do you estimate your cast iron piping will be completely removed in your state?

Top 11 States with Cast Iron

Questions →	A		B		C	D	E	F		G
STATE ↓	Yes	No	Yes	No				Yes	No	
AL	1		1		2008-2009 at 3.7%/year	Based on leak history, public infrastructure excavation activity, publ. improvements, etc.	2040	1		
AR-OG		1								
AR-PSC	1		1		2003-2009 at 28 mi/yr	All piping	2022			
AZ		1								
CA-PUC	1		1		1985 - 2009: 31 mi/ year	All piping	2015	1		
CA-SFM		1								
CO	1			1	Xcel Energy has approx. 80 miles of CI in Colorado. A replacement program has been initiated by Xcel Energy with two construction seasons of work they have replaced approx. 20 miles of the highest leakage piping in their system. The CY 2011 work went out for bid and work will start around Feb 15th – third season of replacement activity.					
CT	1		1		Vary by operator	All piping (cast iron & bare steel) based on risk	2080	1		
DC	1		1		4- 5 mi/year	Any cast iron pipe	2060	1		
DE	1			1	107 miles left	Voluntary replacement	??			
FL-PUC	1		1		27% per year in 10 years	All cast iron & bare steel prioritized equally	2017	1		
GA	1		1		2003: 494 mi remaining; 2010: 55 mi remaining	All piping	2015	1		

Questions →	A		B		C	D	E	F		G
STATE ↓	Yes	No	Yes	No				Yes	No	
IA	1			1	2002: 96 mi remaining ; 2009: 22 mi in house operator capital improvement program	all piping				
ID		1								
IL	1		1		Nicor: 15-30 mi/year; Peoples: 95 to 100 mi/year	Based on leak history, graphitization, excavation activity, publ. improvements, etc.	2031	1		
IN	1			1	Two operators allowed rate recovery; rate of replacement depends on cost	All piping	2013		1	Unknown
KS	1		1		Determined by operator	3 inch & less; then by amount of graphitization observed	2013	1		
KY	1		1		Main replacement program covering cast iron and other piping	Varies	??		1	??
LA	1			1	Voluntary replacement	All pipe	2016		1	
MA	1		1		Average of 50 mi/year since 1991	4132 miles left	??			??
MD	1			1	n/a	n/a	n/a		1	n/a
ME	1		1		Replacing 4 to 5 mi per year	All piping	2014		1	2017 if delay
MI	1		1		First operator 22 mi/year to replace 553 mi; another operator has no time frame	Unprotected metallic pipe including cast iron replacement based on risk	2040		1	
MN	1			1	Voluntary replacement @ 5 to 6 mi/year	Based on risk or location of city project	none		1	none
MO	1		1		55 mi / year	Based on risk, leakage & graphitization	2059	1		
MS	1			1	As needed, voluntary	All cast iron	??	1		
MT		1								
NC		1								
ND		1								
NE	1			1	none	none				
NH	1		1		Adjustable by commission	Piping less than 8 inches in diameter; couplings used for fittings	2035		1	98% replaced
NJ	1		1		2006 - 2010: 86 mi/year	Based on risk: small diameter; hi & lo press; 10 to 12 in. hi press. (@ 1 psig or more)	2035		1	unknown
NM		1		1						
NV		1								
NY	1		1		Depends on operator	Determined by risk assessment	2090	1		

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Questions →	A		B		C	D	E	F		G
STATE ↓	Yes	No	Yes	No				Yes	No	
OH	1		1		Depends on operator	All piping	2030	1		
OK		1								
OR		1			Completed in 2000		2000	1		
PA	1		1		1% per year; 1500 mi remaining		2111	1		
PR		1								
RI	1		1		2008: 11 mi replaced; 2009: 6miles replaced; 890 miles remaining	Size varies based on risk assessment	2100			
SC		1			Completed in 1994		1994	1		
SD	1			1	Operator has in-house program					
TN	1		1		10% of pipe per year	All cast iron and ductile iron pipe	2025	1		
TX	1			1	Voluntary replacement at 5%/yr	Risk-based, leakage history, public works	2025	1		
UT		1								
VA	1		1		Depends on operator: from 0 to 18.9 mi/year	All piping based on risk	2035		1	unknown
VT		1					2006			
WA		1					2009			
WI		1					1999	1		
WV	1		1		1 to 1/5 mi/year	Cast iron & bare steel prioritized equally	2017	1		
WY		1					1999			
Totals	34	18	23	12				19	10	
Total States responding	52									

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Appendix 3
Fitness for Service

What is Fitness for Service?

The term "Fitness for Service" has recently come into more frequent use in OPS and the pipeline industry. At the recent National Pipeline Safety Forum in Washington, D.C., a number of speakers proposed fitness for service as a more appropriate criterion for making decisions about repairing, replacing, rehabilitating or requalifying older pipelines rather than a single criterion such as age, material, or welding technique. But what does fitness for service really mean, and how should it be determined? Importantly, what is the relationship between fitness for service and Integrity Management?

Fitness for service is a well-known term in the reliability engineering world. A fitness for service assessment is a multi-disciplinary engineering analysis of a piece of equipment (such as a pipeline, tank, valve, pump, or any individual component) to determine if it is safe and fit for continued service until the end of some desired period of operation (for example, until the next inspection, or until the end of its useful life).

API Recommended Practice 579 provides a general procedure for assessing fitness for service for pipes and other process equipment such as pressure vessels and tanks. This standardized assessment procedure provides "technically sound consensus approaches that ensures the safety of plant personnel and the public while aging equipment continues to operate, and can be used to optimize maintenance and operation practices, maintain availability and enhance the long-term economic performance of plant equipment"[13].

Fitness for service assessments are quantitative engineering evaluations performed to evaluate the structural integrity of component that may contain a flaw or damage. The assessment evaluates the remaining strength of the equipment in its current condition (which may be degraded from its original conditions due to corrosion, embrittlement, mechanical damage, or other mechanisms), and then uses this information to project a remaining safe-operation life of the equipment. An input needed for this assessment is an understanding of the physical condition of the subject equipment.

The basic question answered by a fitness for service assessment is "Given what we know about the current physical condition of this equipment, our technical knowledge of how this condition could deteriorate over time, and well-defined acceptance criteria for safe operation, will the equipment be able to operate safely until some designated time in the future?"

The main output of a fitness for service assessment is a decision to run, alter, repair, monitor, or replace equipment. In addition, a fitness for service assessment can provide additional guidance on equipment inspection and testing intervals. While RP 579 was not developed specifically for transmission, distribution, or gathering pipelines, the general process still applies.

Implications to Gas and Hazardous Liquid Transmission Pipelines

Given the above definition of fitness for service, there are some obvious parallels and overlaps between a fitness for service assessment and what a pipeline operator is required to do under its Integrity Management Program (IMP). Fitness for service also focuses on an engineering evaluation of individual components, rather than the more system-oriented and risk-based IM Program. However, the current IMP regulations could be interpreted as requiring some form of fitness for service. Two critical decisions required as part of an IMP are (a) what defects identified by the assessment should be repaired and by when, and (b) how frequently should assessments that characterize the physical condition of a pipeline be carried out. The IMP regulations provide a prescriptive answer to the first questions, and impose a maximum reassessment interval as the answer to the second question. However, the IMP regulations for both gas transmission and hazardous liquid pipelines require the operator to evaluate whether the known condition of the pipeline and the nature of threats affecting its integrity dictate that an assessment should be carried out earlier than required by the maximum interval.

[13] API 579-1/ASME FFS-1, June 5, 2007 (API 579 Second Edition)

It should be noted than only transmission pipelines with potential to affect an HCA are required to comply with the requirements of the IMP regulation; so much of the nation's pipeline infrastructure is exempt from these regulations. Currently pipe segments not subject to IMP regulations are determined to be fit for service by being in compliance with the extensive set of regulations imposed on pipeline systems. These regulations are based on a continuing surveillance process that includes monitoring operations and maintenance activities that are conducted at frequencies as specified in Parts 192 and 195 (for example: leak surveys, cathodic protection measurements, patrolling, and atmospheric corrosion observations).

Implications to Natural Gas Distribution Systems

Operators have historically had broad-scope programs to manage the integrity of their distribution systems. The recent Distribution Integrity Management Program (DIMP) regulation requires operators to formalize their distribution pipeline safety programs. Under DIMP operators will track and trend the safety performance of various groups of materials in their distribution systems, for example, coated and cathodically protected steel mains or polyethylene service lines. Typical metrics would be leaks per mile of main and leaks per thousand services, by type and classification (mains or services) of material. Age alone is not the determining factor in leak rate. In some cases, a 40 year old facility may no longer be fit for service while in other instances a facility more than twice as old may continue to be fit for service based on condition and performance.

As a requirement of federal regulations, operators conduct instrumented leak detection surveys on their distribution facilities on a periodic basis ranging from 12 months to 60 months depending on the type and location of the facility. The vast majority of leaks identified on distribution systems do not present a threat to public safety.

Specific facilities or groups of facilities with similar physical characteristics, whose performance begins to significantly deteriorate as demonstrated by an increasing frequency of leaks over time, may no longer be considered fit for service and should be considered for "smart modernization". Smart modernization is the targeted, risk-based rehabilitation or replacement of specific assets based on the condition and performance of those assets. Rehabilitation or replacement of large groups of facilities may take many years to complete. Major replacement programs are often constrained by the ability and willingness of Public Utility Commissions, through rate cases, to allow the operator to recover associated costs.

Approximately 22 states have infrastructure replacement cost recovery mechanisms. Broad mandates to rehabilitate, replace or requalify a vintage or type of distribution material may be counter-productive to pipeline safety because they are not risk-based. Mandating scarce resources be used to replace facilities that are performing well effectively limits the availability of resources to rehabilitate, replace or requalify higher risk facilities. Independent of their asset replacement program, operators will continue to manage their assets through mitigation actions (such as increased leak monitoring) under their DIMP Programs until the rehabilitation or replacement is complete.

What is next in Fitness for Service?

The reliability engineering definition of fitness for service doesn't seem to apply to the suggested application of the concept to pipelines. This implies the need for a cross-industry collaboration to develop a shared understanding of what the term means and how best to determine fitness, followed by needed adjustments to the IMP regulations. The key questions seem to be: (a) Does operator know what it has in the ground? (b) How does it know the pipe hasn't changed enough to be of concern? (c) In light of the existing API-RP, is a new term necessary? (d) If so, does it relate to a decision on replacement of pipe? And (e) How can the fitness for service concept be used to complement IMP regulations?

Appendix 4
Pipeline Operator Compliance Programs

OPS' pipeline safety regulations are contained in 49 CFR Parts 190 through 199. These are cradle to grave regulations, addressing all aspects of a pipeline's lifecycle including design, construction, initial testing, operations and maintenance, personnel qualifications and drug testing, emergency response, all the way through abandonment. The OPS regulations also incorporate by reference over sixty national consensus standards addressing things such as tank design and inspection, pipeline welding, pipe manufacturing, pipeline leak detection, control room system design, corrosion control, all of which also mandate how operators are expected to comply with the regulations.

Operators are required to develop comprehensive written procedures and specifications to *address all aspects of a pipeline's lifecycle*. Design and construction of pipelines covers not only new pipe installations, but changes to existing pipeline systems. Design regulations require that operators ensure that the pipe will maintain its structural integrity for its type of service and operational conditions. The pipe, components, fittings, closures, flanges, and tanks all must meet engineering design criteria and testing. Construction must be made in accordance with comprehensive written specifications and standards that address material inspection, transportation of pipe, bending, welding, weld testing, backfilling, depth of cover, location of valves, and the documentation of construction through records retained for life of the pipe.

The Operations & Maintenance (O&M) Manual contains all the written procedures for conducting normal operations and maintenance, as well as abnormal and emergency operations and must be reviewed annually. Normal operating procedures must cover how to *start up, operate, and shutdown* a pipeline within required operating limits. Each pipeline must have a pre-determined *maximum operating pressure limit*. Abnormal operating procedures must outline how to *identify, respond to, and mitigate abnormal events*. Liquid pipeline operators are required to have *a leak detection system* which may range from routine station checks at manned facilities to complex computer programs that monitor flow and pressure and often provide alarms for pipeline controllers when necessary. Operating procedures must itemize what to do when an emergency occurs, including procedures on how to control, respond to, and analyze the cause of accidents. OPS has documented the types of accidents that operators are required to report.

Maintenance procedures must identify how an operator will complete required inspections and maintenance. Operators must maintain accurate maps and records of their pipelines and facilities, and often this includes information based in systems like GPS. Pipelines must be identified with markers; facilities must be marked and secured to protect from unauthorized entry. Operators must inspect and maintain pipeline markers as well as the pipeline right-of-way, including navigable waterway crossings, to ensure that nothing interferes with normal operation. Operators must have means to control corrosion, which often includes coating pipe or using cathodic protection. Pipeline valves, overpressure devices, and systems providing corrosion control are subject to regular inspection to ensure they are functioning properly. Maintenance activities also include surveillance and patrolling to help identify issues. When a pipeline is no longer used or is abandoned, final maintenance procedures are performed.

Personnel performing operations and maintenance *tasks*, including pipeline controllers, are required to be qualified to perform these tasks. Qualification includes not only demonstrating how to complete the task, but also knowing what can go wrong when completing the task. These personnel are subject to OPS' mandatory Drug and Alcohol Testing program. Additional procedures ensuring worker safety, including subjects like trenching, preventing accidental ignition, and safe access to tank roofs are required. Public safety must also be addressed in every operator's procedures and are included in Public Awareness programs in which the affected public, contractors, public officials, and emergency responders are informed about pipelines and pipeline safety. Along with Public Awareness, operators must have a Damage Prevention Program which works to ensure that pipelines are safe from damage due to digging or other excavation. Operators must participate in a Call Before You Dig/811 program.

Integrity Management Program (IMP) regulations apply to pipelines in or affecting High Consequence Areas (HCAs). HCAs are defined differently for gas pipelines and liquid pipelines, since they pose different types of hazards. HCAs for gas pipelines are based on population density directly adjacent to the pipeline; and for liquids pipelines, HCAs are areas of population, waterways, drinking water sources, and ecologically-sensitive areas. An IMP requires that each pipeline be

assessed to determine its potential affect to an HCA. Risk assessments are a required component in an IMP and are based on all the knowledge an operator has gained about its pipeline, including all the threats to the pipeline's integrity. Assessments are conducted in risk-priority order, and assessment methods must be chosen to address all the identified threat for liquids pipelines. OPS has mandated the maximum interval for assessment cannot exceed 5 years for hazardous liquids and 7 years for gas transmission pipelines. Based on known characteristics, a pipeline may be required to be assessed sooner. Assessment methods include in-line inspection tools ("smart pigs") which gather information as they travel inside the pipe; pressure testing with water; external corrosion direct assessment; and upon notification to OPS, other technologies that provide similar integrity information. Operators are required to analyze the assessment information to identify conditions that might affect the integrity of a pipeline. OPS has outlined the specific conditions under which identified anomalies require repair. Depending on the type of anomaly, specified repair timeframes have been set by OPS. Many pipeline operators voluntarily exceed the minimum standards required by OPS, for example, by applying IMP inspection and repair criteria to all pipelines, not just those required to be covered by their IMP program.

Distribution Integrity Management Program (DIMP) regulation takes effect in August of 2011. This regulation is different from IMP for cross-country pipelines in several important ways. First, it applies to the entire distribution system which is, in effect, in an HCA. Second, DIMP has no requirement to physically inspect the pipeline since numerous design and technology factors make physical inspection possible only by digging up the pipe, which would be prohibitively expensive. Third, distribution pipelines leak, so a major element of DIMP is an effective leak management program. These differences place increased importance in the operator developing a thorough understanding of its system, the threats to which it is exposed and the resulting risk profile. The operator then uses this understanding to identify additional and accelerated (AA) actions as the focus of its risk management. One of the candidate AA actions is replacement of the highest risk pipe segments, a costly activity requiring treatment in a rate case to support paying for its implementation.

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Appendix 5
Eliminating Excavation Damage

An important area of shared responsibility in pipeline safety is excavation damage prevention. OPS has led and continues to lead this effort by sponsoring initiatives aimed at improving damage prevention. Here are a few examples.

Summary of State Damage Prevention Laws

In 2010, OPS enlisted the help of the North American Telecommunications Damage Prevention Council (NTDPC) to survey and summarize state damage prevention laws relative to specific characteristics, such as requirements applicable to excavators and utility operators. OPS has posted this summary on its Stakeholder Communications website and has developed an interactive application for website users.

Common Ground Study

In 1999, OPS published the Common Ground Study of One-Call Systems and Damage Prevention Best Practices (http://www.commongroundalliance.com/Content/NavigationMenu/Best_Practices/Common_Ground_Study/CommonGroundStudy090499.pdf). This report was the result of one intense year of interaction among stakeholders in preventing damage to all underground utilities. The Common Ground Study established best practices for all stakeholders to utilize in preventing excavation damage. Following the completion of the Common Ground Study, the Common Ground Alliance (CGA) was established as a nonprofit organization to foster the spirit of shared responsibility among all parties involved in the damage prevention process and provide stewardship for the damage prevention best practices.

Call 811 Before You Dig

A major role of the public in preventing pipeline accidents is assuring that homeowner and contractor excavation activities do not damage pipelines. Smart digging means calling to have underground facilities located before beginning each excavation. Homeowners often make risky assumptions about whether or not they should call to get utility lines marked, but every digging job requires a call - even small projects like planting trees and shrubs. OPS supported the initiative that led to approval by the Federal Communication Commission of the national, three-digit toll-free 811 number. By dialing 811, excavators anywhere in the country can connect to the one-call center to request a facility locate. More information is available at the following web site http://www.call811.com/ .

Operator Public Awareness Programs

Pipeline companies are required to establish public awareness programs that educate the public and others on recognizing and reporting pipeline emergencies. Recent new rules enhance the requirements for these programs to improve public awareness and pipeline safety. You can learn more about operator public awareness programs at http://primis.phmsa.dot.gov/comm/PublicEducation.htm?nocache=3497 .

The Public Must Recognize, Respond & Report Incidents

The aforementioned operator public awareness program regulations require that operators communicate information to the public on how to recognize, respond to, and report pipeline incidents. Emergencies can occur in the home or workplace, or outside, along a pipeline right-of-way. Understanding how to recognize, react and report an incident can save lives. As with other emergencies, reporting pipeline emergency is as easy as dialing 911. The public can see briefly what to do and what not to do on recognition of a pipeline leak, both inside and outside the home, on OPS' Stakeholder Communications website at http://primis.phmsa.dot.gov/comm/EmergencyResponse.htm?nocache=4695 .

Initiatives to Eliminate Excavation Damage

Common Ground Study and Common Ground Alliance – Third-party excavation damage has always been a major contributor to pipeline incidents. Prior to 1998 it was all too often viewed as beyond the control of the operator and

outside the purview of the regulator. This view ended with the Common Ground Study initiated in 1998 leading to the publication in 1999 of the Common Ground Study of One-Call Systems and Damage Prevention Best Practices. Following completion of the Common Ground Study, the Common Ground Alliance (CGA) was established as a nonprofit organization to foster the spirit of shared responsibility among all parties involved in the damage prevention process. OPS continues to support the CGA, which is now comprised of almost 1,400 volunteer members who work together to identify and promote best practices aimed at preventing underground facility damage and keeping communities and the environment safe. Information on the CGA is available at www.commongroundalliance.com .

Damage Prevention Program Elements - As part of its preparation for drafting the distribution integrity management regulation, OPS assembled several teams to prepare perspectives on the major opportunities for improvement. One working group was focused on excavation damage prevention. Among the observations from this group was that states with comprehensive damage prevention programs that include effective enforcement have a substantially lower probability of excavation damage to pipeline facilities than states that do not. The working group characterized a comprehensive and effective damage prevention program as requiring nine important elements. These nine elements, which were cited by Congress in the Pipeline Inspection, Protection, Enforcement and Safety (PIPES) Act of 2006, have formed the basis for requirements in the upcoming Notice of Proposed Rulemaking discussed below.

Expanded Enforcement Authority - Following publication of an ANPRM in October 2009, OPS will publish a Notice of Proposed Rulemaking (NPRM) pertaining to state damage prevention law enforcement programs. This NPRM proposes to amend the federal pipeline safety regulations to, among other provisions: (1) Establish criteria and procedures OPS will use to determine the adequacy of state pipeline excavation damage prevention law enforcement programs; (2) Establish the federal standards OPS will enforce in states with inadequate excavation damage prevention law enforcement programs; and (3) Establish the adjudication process for enforcement proceedings against third-party excavators where federal authority is exercised.

OPS' goal is to minimize the need to take direct federal enforcement action against excavators that damage pipelines by encouraging states to strengthen their excavation damage prevention laws to include the authority to impose civil penalties against persons who violate those laws and to adequately enforce those laws through the use of civil penalties.

State Damage Prevention Program Characterization - In 2010 OPS completed the State Damage Prevention Program Characterization (SDPPC) initiative to better understand the characteristics of damage prevention programs within each state. State programs were characterized against the nine elements of effective damage prevention that were defined in the Pipeline Inspection, Protection, Enforcement and Safety (PIPES) Act of 2006. Working with state pipeline safety program managers and one-call centers, OPS sought to gain a better understanding of the successes and challenges existing in state damage prevention programs, where states need improvement, and where OPS should focus its assistance. The results of the State Damage Prevention Program Characterization are available at http://primis.phmsa.dot.gov/comm/SDPPCDiscussion.htm?nocache=9393. These program characterizations will no doubt change as states take steps to strengthen their programs.

Pipelines and Informed Planning Alliance (PIPA) – PIPA is an historic partnership led by OPS involving 130-member coalition made up of representatives from the pipeline safety community, local city and county governments, the public, developers, fire marshals, pipeline operators, and state and federal regulators. In December 2010 OPS issued the PIPA Report to help local governments, developers, and community planners better ensure safety in areas near transmission pipelines. The PIPA Report marks the first time a set of recommendations for land use and development near existing transmission pipelines has been issued.

The PIPA Report offers nearly 50 recommended practices for local communities, developers and pipeline operators to use to help reduce the safety risks that result from growth of communities near pipelines. The recommendations offer options on how land-use planning and development decisions can help protect existing pipeline infrastructure and growing communities. The report also provides recommendations on how communities can gather information about local transmission pipelines and how local planners, developers and pipeline operators should communicate during all phases of new development to understand pipeline risks, and how to minimize pipeline excavation damages during site preparation and construction. The PIPA Report is available online. (http://primis.phmsa.dot.gov/comm/pipa/landuseplanning.htm)

Additional information on the numerous initiatives to prevent damage to pipelines can be found at - http://primis.phmsa.dot.gov/comm/DamagePrevention.htm?nocache=8838

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Appendix 6
How are Cross-Country Pipelines Sited?

Gas Transmission Pipelines

The Federal Energy Regulatory Commission (FERC) is charged by Congress with evaluating whether interstate natural gas pipeline projects proposed by private companies should be approved. FERC approves the location, construction, modification, acquisition, operation, and abandonment of interstate pipelines, facilities, and storage fields involved in moving natural gas across state boundaries. FERC may issue a company a case-specific certificate authorizing a particular gas project.

If a proposed pipeline route is on, or abuts privately owned land, the owner will probably be informed by the pipeline company as it plans and studies the route. Once a company files an application requesting FERC to issue a certificate authorizing the construction of a pipeline project, the company will mail the land owner information. FERC's staff will prepare an environmental study of the proposal; either an Environmental Impact Statement or an Environmental Assessment, depending on the scope of the project. For major construction projects, local media may be notified and public meetings may be held where land owners will have an opportunity to express their views. FERC may approve the project, with or without modifications, or reject it. If it is approved and any land owner fails to reach an easement agreement with the company, including compensation for the agreement, access to and compensation for use of the owners land will be set by a court.

Liquid Pipelines

From the Rabinow Report – A liquid pipeline operator desiring to develop a new line has a number of options for acquiring a right of way. An analysis of the alternative routes and the issues associated with each is the starting point. Once a preferred route has been selected the pipeline has the option of buying the right of way or approaching the landowners along the proposed right of way and negotiating voluntary agreements for easements. If that fails, and the proposed pipeline will be a common carrier, the pipeline company may be able to resort to using its right of eminent domain that is spelled out in the statutes of the particular state.

Today, the acquisition of rights of way (an agreement with a private landowner or a permit from a public landholder) can take extended periods, often much longer than the time required to construct a pipeline, is increasingly costly and often ends in litigation that can drag on for years and sometimes a decade or more. In right of way negotiations, land owners typically seek to limit the width of easements and to fight constraints on their use of the land immediately over the buried pipeline. http://www.aopl.org/pdf/rabinow.pdf

Pipelines Crossing an International Border

The Secretary of State has the authority to issue Presidential Permits for cross-border petroleum product pipelines. The Office of International Energy and Commodity Policy receives and processes permit applications. In consultation with the Department of State, FERC issues cross-border natural gas pipeline permits.

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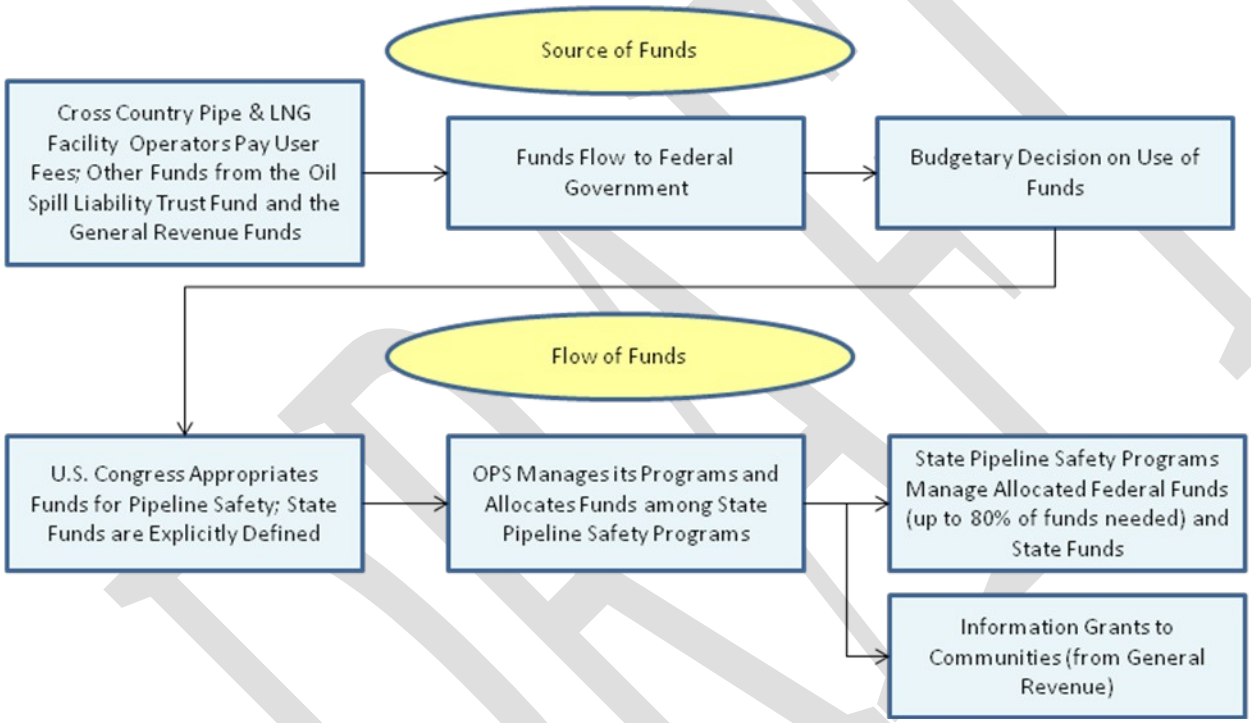
Appendix 7
How Regulators are Funded

Funding for pipeline safety is appropriated by Congress. The Pipeline Safety appropriation is funded by user fees and a general revenue fund from the following sources: the Pipeline Safety Fund, the Oil Spill Liability Trust Fund, and the General Fund (Information Grants to Communities). The Pipeline Safety Fund consists of annual user fees collected from OPS' regulated industry (hazardous liquid and natural gas cross-country pipeline operators and liquefied natural gas (LNG) facility operators). The Oil Spill Liability Trust Fund, a revolving fund, collects an environmental fee on petroleum production and transportation. These fees are based on the enacted Congressional budget and used to implement PHMSA's Pipeline Safety program. General Revenue funding is used for the Information Grants to Communities.



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Appendix 8
State Requirements beyond the Minimum Federal Standards

Awaiting Input

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Appendix 9
Roles of Select Stakeholders in Pipeline Safety

Federal Government Agencies

Numerous agencies of the federal government have roles in ensuring pipeline safety. The roles of agencies such as the National Transportation Safety Board; the Office of Management and Budget; the Transportation Security Administration; the Bureau of Ocean Energy Management, Regulation and Enforcement; the U.S. Coast Guard, the Federal Energy Regulatory Commission, and the Environmental Protection Administration are described below.

Other federal agencies have shared responsibilities for certain aspects of pipeline safety. The discussion below briefly describes the major federal agencies with responsibilities related to pipelines and their safety. *The Department of Energy (DOE)* also has responsibility for energy supply reliability evaluations.

National Transportation Safety Board (NTSB) - The NTSB mission is to promote transportation safety by, among other responsibilities: conducting objective, precise accident investigations and safety studies; and advocating and promoting safety recommendation. The Pipeline staff investigates accidents occurring during the transport of natural gas or other hazardous liquids, such as gasoline or propane, through pipeline systems and accidents in which public safety is threatened by the release of hazardous substances. The Division investigates all pipeline accidents in which there is a fatality, substantial property damage, or significant environmental impact.

The Office of Management and Budget (OMB) is a key player in the issuance of any new regulation. The Office of Information and Regulatory Affairs (OIRA) in OMB reviews draft regulations considered to potentially have a significant cost impact on those being regulated to ensure they include consideration of alternatives to the rulemaking and analysis of the rule's effects on society, both its benefits and costs.

The Transportation Security Administration (TSA) within Department of Homeland Security (DHS) is responsible to reduce security vulnerabilities and to strengthen resilience against terrorist attacks. TSA is responsible for four subsectors: mass transit and passenger rail, highways and motor carriers, freight rail, and pipelines. DHS has completed risk-based implementation plans focusing on improving information sharing, increasing coordination among federal agencies involved in the transportation sector, and improving the effectiveness and efficiency of the grants process.

The Department of the Interior's (DOI), *Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)*, is the federal agency responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the Outer Continental Shelf. OPS and BOEMRE often have oversight for coupled facilities on the same offshore platform. A Memorandum of Agreement has been established involving OPS and BOEMRE to assure coordination and consultation in developing and inspecting requirements for all offshore pipelines to avoid conflict and unnecessary duplication.

The Bureau of Land Management (BLM) is an agency within the Department of Interior, responsible for the management of approximately 261 million acres of federal lands, principally in 12 western states, including Alaska. BLM's responsibilities include issuing right-of-way grants and permits for energy pipelines.

The Environmental Protection Agency (EPA) is responsible for administering a wide variety of environmental laws. Responsibilities relevant to pipeline activities include commenting on Environmental Impact Statements, participating in Clean Water Act permitting activities, and reviewing authorized state's issuance of National Pollutant Discharge Elimination System permits for discharges of storm water from construction activities affecting more than one acre. Construction and replacement of pipelines, which are usually buried structures, involves considerable excavation and hence the involvement of EPA in various permit-related activities.

Among other responsibilities, the *U. S. Coast Guard (USCG)* is responsible for safety, engineering and safety standards and facility inspections at our nation's deepwater ports, including natural gas and liquefied natural gas (LNG) facilities. OPS has established and oversees compliance with regulations that govern the safety of LNG facilities in the U.S.

Additionally, OPS is working with the U.S. Coast Guard to assure proper review of any application for a new deepwater LNG port facility. OPS and the USCG often have separate but coordinated responsibility for inspecting pipelines on offshore platforms. OPS also shares and coordinates responsibility with EPA and the USCG for inspection and enforcement of provisions in the Oil Pollution Act for developing and ensuring the effectiveness of a Facility Response Plan.

Federal Energy Regulatory Commission (FERC) is an independent agency that regulates certain economic aspects of interstate transmission of natural gas, oil, and electricity. FERC approves both the siting and abandonment of interstate natural gas pipelines, as well as fuel storage and liquefied natural gas facilities. Because outside force damage, including third party damage is a major cause of pipeline accidents, the siting of a pipeline can have important safety implications. FERC has recently asked OPS to support the evaluation of proposed natural gas pipeline siting plans.

Representatives of the Public Interest

This is a very broad category defined to include non-profit organizations that have an explicit role in pipeline safety (such as 811 and 911 organizations) through non-governmental organizations that monitor and intervene in pipeline safety matters (such as the Pipeline Safety Trust). Several of the organizations representing the public interest, such as the Common Ground Alliance and Call 811 Before You Dig, have already been described in Appendix 5 Eliminating Excavation Damage

Pipeline Safety Trust (PST) - promotes fuel transportation safety through education and advocacy, by increasing access to information, and by building partnerships with residents, safety advocates, government, and industry, that result in safer communities and a healthier environment. http://www.pstrust.org/

Natural Resources Defense Council (NRDC) - is an environmental action group, combining the grassroots power of 1.3 million members and online activists with the courtroom clout and expertise of more than 350 lawyers, scientists and other professionals. http://www.nrdc.org/

Call 911 in Case of an Emergency - A call to 9-1-1 will allow the caller to obtain appropriate help from public safety officials based on a description of the situation. The incoming 9-1-1 call is typically answered at the Public Safety Answering Point (PSAP) of the governmental agency that has jurisdiction over the geography from which the call originates. When a 9-1-1 call arrives at the appropriate PSAP it is answered by a specially trained official. In some jurisdictions the official is also the dispatcher of public safety response resources. Calling 9-1-1 is the best way to report a pipeline incident whether it is a suspected gas leak, an oil spill or a major petroleum or gas fire. When you call 9-1-1, be prepared to answer the call-taker's questions, which may include: (a) the location of the emergency, (b) the phone number you are calling from, (c) the nature of the emergency, and (d) details about the emergency, such as a description of any fire that may be burning, or a description of injuries of any person having a medical emergency.
http://www.911.gov/whencall.html

Associations Representing the Public Interest

A partial listing of groups that represent the interests of the public interest, along with their web sites is shown in below.

National Association of State Fire Marshals (NASFM) is an association of the most senior fire safety officials who tend to be responsible for fire safety code adoption and enforcement, fire and arson investigation, fire incident data reporting and analysis, public education and advising Governors and State Legislatures on fire protection. http://www.firemarshals.org/

National Association of Pipeline Safety Representatives (NAPSR) is a non-profit organization of state pipeline safety personnel who serve to promote pipeline safety in the United States and its territories. http://www.napsr.org/

National Association of Regulatory Utility Commissioners (NARUC) is an association of public service commissioners who Commissioners who regulate essential utility services, including energy, telecommunications, and water.
http://www.naruc.org/

National Fire Protection Association (NFPA) is a nonprofit association whose purpose is to is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. www.nfpa.org

International Association of Fire Chiefs (IAFC) is an association whose members are the world's leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, search and rescue, and public safety policy. http://www.iafc.org/

International Association of Fire Fighters (IAFF) is an association that represents more than 298,000 full-time professional fire fighters and paramedics. http://www.iaff.org/

Industry Trade Associations

The pipeline industry is represented by a number of Trade Associations. The most active industry trade associations representing the pipeline industry along with references to their web sites are described below.

- The American Gas Association (AGA) represents 201 local energy companies that deliver natural gas throughout the United States. There are more than 70 million residential, commercial and industrial natural gas customers in the U.S., of which almost 91 percent - more than 64 million customers - receive their gas from AGA members http://www.aga.org/Pages/default.aspx
- The American Public Gas Association (APGA); APGA is the national association of publicly-owned natural gas distribution systems having approximately 700 members in 36 states. http://www.apga.org/i4a/pages/index.cfm?pageid=1
- The Interstate Natural Gas Association of America (INGAA), with 26 member companies that operate approximately 203,000 of the 296,000 miles of onshore gas transmission pipelines http://www.ingaa.org/
- The Association of Oil Pipelines (AOPL) is a nonprofit organization whose membership is comprised of owners and operators of liquid pipelines. AOPL members carry nearly 85% of the crude oil and refined petroleum products moved by pipelines in the United States http://www.aopl.org/
- The American Petroleum Institute (API) has 400 members involved in all aspects of the oil and gas industry, so the vast majority of its members are non-integrated oil and gas companies, pipeline companies, marine companies and their suppliers http://www.api.org/
- National Propane Gas Association (NPGA) has a membership of more than 3,200 companies in all 50 states, 38 affiliated state or regional associations, and members in 19 foreign countries, NPGA represents every segment of the propane industry http://www.npga.org/i4a/pages/index.cfm?pageid=1

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Appendix 10
Additional Challenges and Initiatives

Controlling Threats by Managing Pipeline Integrity

The previous section described the threats that affect pipeline integrity. Many of these threats are directly within the control of an operator (for example, corrosion, incorrect operation, and material or weld failures); however, there are a few important threats that are either outside an operator's control or only influenced by operator's actions (for example, excavation damage and outside force damage). Achieving zero incidents requires that all these threats be effectively managed. Integrity management is the overall management process operators are employing to manage threats under their control, and to identify and repair damage from all threats to which their pipelines are subject.

What are the challenges in managing pipeline integrity?

Understanding an Aging Infrastructure - The 2010 incident in San Bruno California in which a gas transmission pipeline ruptured killing 8 people, seriously injuring an additional 51 people, and destroying 38 residences is an example of a critical principle of integrity management – the need to understand the infrastructure. Because many existing pipelines were constructed before requirements to maintain detailed records of installed piping were imposed (1970), the completeness of operator records and related knowledge of their systems varies considerably. The variation in the quality of records for older pipeline represents a challenge for both operators and regulators.

Since operators have different levels of information on the characteristics of their pipeline systems, their challenge is to use whatever means possible, including carefully observing and documenting pipeline characteristics whenever a segment of pipe is exposed during normal operation and maintenance, to strengthen their knowledge of the pipeline system they operate.

Managing Pipeline Integrity - A pipeline operator's major safety challenge can be viewed as managing the integrity of its pipeline system. Assuring integrity not only assures the availability of the pipeline system to supply hazardous liquid (for example, petroleum products) and natural gas to customers without an interruption in supply, but also assures the safety and minimizes the environmental impact of the system. Integrity management isn't one activity, but a disciplined approach that involves a range of professional specialties and a series of proceduralized activities. The starting point of integrity management is to understand the pipeline in the ground, its specifications, and service record. This knowledge is critical to managing the asset's performance. In addition to asset information from historic records, the industry uses and continues to improve a series of diagnostic tools and techniques to evaluate the condition of their assets. Understanding the strengths and limitations of these tools and integrating that knowledge into their decisions on when to repair or replace, represents a further challenge to operators in managing pipeline integrity.

Improving Human Reliability - The reliable performance of employees whose jobs affect safe operation needs to be assured, both through qualification programs and by assuring the systems within which they work do not inadvertently cause them to take the wrong action leading to an incident or increasing its consequences. This assurance costs money and requires staff and management time. Staff expertise is also a challenge.

Eliminating Excavation Damage - Excavation damage is typically one of the three most significant contributors top pipeline incidents. For many years regulators and operators alike treated it as though it was beyond their control. Beginning in 1998 the pipeline safety community has joined forces with a wide range of other stakeholders to begin identifying and addressing the factors contribution to excavation damage.

How are pressure limits established? - After the 1970 regulation all but grandfathered pipelines were required to be pressure tested to determine the maximum stress (therefore the maximum pressure) at which they were allowed to operate. For grandfathered pipe, that is pipelines exempted from pressure testing, the maximum operating pressures could be established as follows. For hazardous liquid pipelines the limiting pressure was 80% of the highest operating pressure or test pressure in a 4 hour continuous period that can be verified by recording charts or logs. For gas transmission pipelines and gathering lines the limiting pressure was the highest actual operating pressure to which the pipeline was subjected in the five year period between 1965 and 1970.

Managing grandfathered assets - Occasionally in the past when a new regulation was passed, OPS and its predecessor agencies has allowed older systems to be "grandfathered", that is allowed to continue operating under the previously established regulatory constraints. Perhaps the most important case of grandfathering resulted from 1970 regulations imposing for transmission pipelines a maximum allowable operating stress not to exceed 72% of the specified minimum yield strength (SMYS). This 72% requirement represents a safety factor to assure the pipeline will not fail. For gas transmission pipelines this grandfathering was allowed only in Class 1 locations - that is areas in which the lowest number of people resided near the pipeline. At the time of passage many pipelines had been operating at stress levels of 80% SMYS, representing a lower safety factor.

There is no comprehensive industry-wide database to provide information explicitly related to the performance of grandfathered pipelines. However, operator experience shows that the fitness for service of grandfathered pipelines can be managed to produce safety comparable to or better than newer pipelines. Operators typically apply integrity management methods on their grandfathered pipelines, including pressure testing, records validation, and in-line-inspection.

What ongoing Initiatives are designed to address these challenges?

Understanding an Aging Infrastructure - As part of managing compliance with the integrity management program requirements, operators are required to perform detailed threat and risk analyses that integrate accurate data and information from their entire pipeline system, especially when calculating the pressures at which they are allowed to operate their pipelines, and to utilize these risk analyses in the identification of appropriate assessment methods, and preventative and mitigative measures. For the parts of pipeline systems covered by the IMP regulations, these ongoing activities ensure that aging effects will be monitored and repairs completed when necessary.

Distribution operators have their own set of challenges with aging infrastructure. Their safety management approach acknowledges that distribution pipelines occasionally do leak. To manage this reality, they continuously monitor leaks and repair those of concern. While some of the oldest distribution pipelines are made from cast iron, some of which can represent a higher risk, the amount of cast iron is decreasing each year as a result of programs that focus on replacing the riskiest cast iron piping (see Appendix 2).

The age of distribution pipe made of plastic is not the primary factor in their likelihood to leak. The Plastic Pipe Database Committee (PPDC) - a joint industry-regulatory working group - has worked since 1995 gathering data on the causes of excessive pipeline leakage. Their efforts have identified several plastic piping and components that have demonstrated a significantly lower resistance to locally-imposed stresses (like rock impingement) resulting in higher rates of pipe failure. The data indicate that many of the early plastic piping products manufactured in the 1960s to early 1980s are more susceptible to cracking from locally-imposed stresses than newer vintage materials. These more susceptible pipes are the focus of PUC-approved pipe replacement programs.

Managing Pipeline Integrity - Recent improvements in safety performance have been made possible by the industry's multi-billion dollar investment in integrity management programs. The integrity management rules for cross-country pipelines are aimed at high consequence areas. This focus on high consequence areas was chosen to allow operator and regulatory resources to be employed in providing an extra level of assurance in areas where a pipeline rupture could cause the greatest damage.

Some 44% of the nation's hazardous liquid pipelines and 7% of the natural gas transmission pipelines were determined to potentially affect HCAs, and thus receive the enhanced level of integrity assessment and protection mandated by the integrity management rules. However, operators inspect and repair more segment miles than the regulations require. A 2010 industry survey showed that respondents, who operate 54% of the liquids pipeline miles subject to OPS regulation, had inspected nearly 90% of their total pipeline mileage, even though their required inspections would have covered only 56%. Gas transmission pipeline segments in HCAs represent approximately 7% of total mileage. Based on current trends, the IMP regulation will lead to assessment of approximately 49% of the total gas transmission pipeline system.

The regulation on integrity management programs for distribution pipeline systems requires that operators implement a program by August 2011. State and Federal inspectors are completing preparation for inspecting the nation's distribution pipeline systems for compliance with the distribution IMP.

The principle ongoing work on IMP is summarized below.

- OPS is examining whether and how the current IMP regulations for transmission pipelines might be strengthened. It has published an Advanced Notice for Proposed Rulemaking (ANPRM) for onshore hazardous liquid pipelines, and is evaluating the results. It is also preparing to issue an ANPRM for gas transmission pipelines;
- Both the states and the OPS are continuing to inspect transmission pipeline operators compliance with the IMP regulations;
- Performance data from operators that have been subject to IMP requirements for several years are being evaluated for lessons on the effectiveness of the regulations and areas of potential improvement.

Improving Human Reliability - OPS has issued two regulations designed to improve the reliability of key pipeline people. First were the operator qualification regulations that took effect in December 2004. These rules were designed to assure individuals performing safety-related operations and maintenance activities are trained and qualified to perform their responsibilities. The second rule is the new control room management rule, which takes effect in August 2011. This rule requires pipeline operators to establish human factors management plans and to account for National Transportation Safety Board (NTSB) recommendations on supervisory control and data acquisition (SCADA) system displays, alarm systems and controller training. In addition, operators must establish maximum hours-of-service limits and integrate these procedures into existing operation and maintenance, operator qualifications and emergency processes.

SCADA Systems - Hazardous liquid and gas pipelines are often monitored in a control room, often hundreds of miles from the pipeline, through computer-based equipment, such as a SCADA system, that records and displays operational information about the pipeline system, such as pressures, flow rates, and valve positions. These monitoring and control actions are a principal means of managing pipeline operations.

Eliminating excavation damage - Along with other failure cause categories, excavation damage continues to represent a significant threat to pipeline integrity. Depending on the type of pipeline, it is either the leading or second most important cause of serious incidents (that is, those incidents involving a fatality or injury requiring in-patient hospitalization). Over the past dozen years, the industry and regulatory perspective on excavation damage has changed significantly from the view that it is "uncontrollable" to the view that there are numerous actions of considerable value in better controlling this threat.

There are numerous initiatives aimed at eliminating excavation damage. Among the most significant are the Common Ground Study and Common Ground Alliance, definition in the DIMP of the element in an effective damage prevention program, expanded enforcement authority, State Damage Prevention Program Characterization, and the Pipelines and Informed Planning Alliance (PIPA). These are described more completely in Appendix 5.

Managing Grandfathered Assets - Since there is no evidence that grandfathered pipeline assets are more prone to incidents than other parts of the aging infrastructure, these assets are being addressed as a part of the other the initiatives on understanding an aging infrastructure and managing pipeline integrity.

Managing Safety through Compliance with Regulations

The minimum safety standards for pipelines are established by OPS. OPS' pipeline safety regulations are contained in 49 CFR Parts 190 through 199. These are cradle to grave regulations, addressing all aspects of a pipeline's lifecycle including design, construction, initial testing, operations and maintenance, personnel qualifications and drug testing, emergency response, all the way through eventual abandonment. Operators are required to develop and implement comprehensive written procedures and specifications describing how they manage virtually every aspect of a pipeline's lifecycle, including the threats affecting the integrity of their systems. The OPS regulations also incorporate by reference over sixty national consensus standards addressing things such as tank design and inspection, pipeline welding, pipe

manufacturing, pipeline leak detection, control room system design, and corrosion control. This section addresses only four of the numerous issues an operator must attend to in complying with pipeline safety regulations.

Recognizing and Dealing with Technology Limitations

Innovative technologies exist for use in helping operators manage pipeline integrity. An operator can purchase hardware to detect leaks. Technology is available to conduct an in-line inspection of a pipeline. For piping that is configured so in-line inspection is not possible, technologies have been integrated into a process called "direct assessment" which is capable of identifying certain pipeline defects and providing some indication of how severe these defects might be. Another level of integrity assurance results from conducting a pressure (hydrostatic) test of a segment of pipeline. During a hydrostatic test certain severe defects will cause the pipeline to rupture. Ruptured segments are then repaired or replaced with pipe of known integrity.

In-line Inspection or Smart Pigging - In-line inspection or "smart pigging" of a pipeline involves use of one or more highly instrumented devices that move through a pipeline to identify and characterize potential defects in the wall of the pipeline that might compromise its integrity. Different "smart pigs" are capable of characterizing corrosion, cracking or dents in the pipeline. These devices are called pigs because of the noise they make when moving through a pipeline.

The challenges associated with these technologies relate to their limitations. Individual leak detection technologies are typically capable of identifying leaks only in a limited size range. Not all pipe defects can be detected by every type of in-line inspection device. Direct assessment is only useful for identifying some conditions leading to corrosion. Pressure (hydrostatic) testing can increase the size of certain defects that are too small to cause the pipe to rupture. Even in-line inspection tools that are designed to detect a certain type of defect are limited in their accuracy.

The result of these challenges is that an operator must have people who recognize the limitations of the technologies they apply to improve the integrity of their pipelines, and these limitations must be specifically incorporated in interpreting the level of assurance resulting from their use.

Ongoing Initiatives – In addition to compliance inspections, the principle mechanisms used by OPS to ensure application of technology with a clear understanding of its limitations are its Research Development & Demonstration (RD&D) Program, technical workshops, and Safety Advisory Bulletins. A principle objective of the RD&D program is to conduct studies and research to support improved understanding of the applicability and limitations of technology. As examples, projects have examined the applicability of various technologies to evaluate pipeline condition using direct assessment and have evaluated the accuracy of in-line inspection technologies.

Workshops are organized to facilitate technical exchanges on issues of current concern, such as new pipeline construction issues; managing the challenge with pipeline seam welds; improving pipeline risk assessment and record keeping; and guidelines for the integrity assessment of cased pipe.

OPS uses safety advisory bulletins to inform affected pipeline operators and federal and state pipeline safety personnel of issues that have the potential to become safety or environmental risks. Examples of safety advisory bulletins can be found at http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin .

Recognizing & managing the challenges of new construction

Recognizing and addressing the issues associated with new construction projects - including materials, construction practices and workforce qualification - is one of the most important means regulators and operators have to assure the pipeline infrastructure of the future has the needed integrity to meet our supply needs and safety expectations.

In 2007, the pipeline industry experienced a major increase in the number of construction projects. This placed a significant strain on the labor workforce required to build the new pipelines, and resulted in difficulties in finding qualified construction contractors and in construction quality problems. During this time period new requirements on material, design and construction - requirements more stringent than those used previously - were being pilot tested. OPS inspections of some of these construction projects identified quality concerns with pipeline coating, welding and

backfilling. Late in 2007 OPS and the industry began discussing these quality issues and exploring ways to improve. After 2008 and 2009 the level of construction has returned to more normal levels. The resulting reduction in demand for construction resources and significant efforts to learn from experience have reduced the likelihood the issues from 2008 and 2009 will be repeated.

Because the pipeline system is expected to continue to expand in the future, effective management of new construction will continue to be a critical challenge.

Ongoing Initiatives - Following the identification of construction problems in 2007, OPS issued Advisory Bulletins and a new regulation to address the identified issues. In May of 2009, OPS issued an Advisory Bulletin on its concerns with the mechanical properties of the materials being used in certain new construction projects. It identified the need for operators to: review manufacturing procedure specifications and test results, review pipe specifications and technical documentation review (pipe production test results, hydrostatic test results), and based on knowledge and findings, consider using a special in-line inspection tool (deformation tool) to detect pipeline expansion.

OPS also issued a challenge to the trade associations to explore how the industry and OPS can define and prevent the problems identified during new pipeline construction projects in 2008 and 2009. Specific challenges included to:

- Identify which underlying standards or regulations need to be examined or changed to help improve pipeline fabrication and construction quality control;
- Determine what other ideas to improve overall fabrication and construction quality control does the industry believe warrant additional attention (for example, is there value in developing a more comprehensive quality management system standard to make these improvements);
- Determine which testing and quality control requirements are the minimum needed for new pipeline construction projects to ensure their fitness for purpose prior to commissioning;
- Identify process and technology improvements needed to ensure that workers employed in these fast-paced and challenging construction projects are fully trained and qualified to carry out their duties competently.

In March 2009, the INGAA Foundation hosted a two day workshop focused on construction issues. In April 2009, OPS also sponsored a workshop - in collaboration with its state partners, the Federal Energy Regulatory Commission (FERC) and Canada's National Energy Board (NEB) - aimed at reviewing the lessons learned from construction inspections, alerting the industry to current issues, informing the public, and improving new pipeline construction practices prior to the 2009 construction season.

Following the two meetings, INGAA held a Pipeline Summit designed to understand the experiences of construction contractors, pipeline companies, pipeline inspectors and others, and to explore and communicate ways to resolve the issues. As a result of the Summit, six working groups were formed by INGAA in 2010 to address the various technical and quality management issues that were observed with recent construction projects. One of the working groups was specifically formed to examine Quality Management Systems (QMS) and how they can be applied to pipeline construction projects. These various working group included representation from pipeline operators, OPS, API, construction contractors, third party inspection companies and engineering consulting companies. The INGAA Foundation has begun publishing reports from these various working groups in 2011. While new approaches are being developed to assure pipeline quality, OPS continues its aggressive inspection of new construction projects.

Improving Public Awareness

While there are existing federal and state requirements for pipeline operators to communicate with owners and residents near pipeline right-of-ways and easements, strengthening and expanding awareness continues to be a major challenge. Improving public awareness is critical and challenging in at least three areas. First is awareness of the proximity of pipelines to people's residences and businesses so any excavations they undertake are preceded by call 811 before digging

to avoid excavation damage. Second, is to assure owners and residents living on or near pipeline right-of-ways and easements are aware and understand the importance of maintaining a clear right-of-way to facilitate aerial inspection of the right-of-way. Finally, there is a strong trend for residential neighborhoods to expand across pipeline right-of-ways that were previously in the country. The zoning restrictions associated with suburban expansion are at best fragmented and at worst silent on the presence and potential impact of near-by pipelines.

Ongoing Initiatives – The regulatory community continues to be challenged by how best to communicate with the public to achieve its objective of continuing to improve pipeline safety. OPS continues to improve its stakeholder communication website as another means for better informing the public about pipelines. http://primis.phmsa.dot.gov/comm/

OPS and the pipeline industry are seeking to improve the public awareness of pipelines. Increased awareness is important because people living near pipelines can impact the safety of pipelines by encouraging reporting of excavation near buried lines. Also the public needs to understand how to respond if a pipeline incident occurs near their homes or workplaces. The American Petroleum Institute's Recommended Practices RP1162, *Public Awareness Programs for Pipeline Operators*, focuses on public outreach to help prevent damage to pipelines. This practice is currently being updated; the updated version will be considered for reference in the pipeline safety regulations.

National Pipeline Mapping System (NPMS) - Another example of an ongoing initiative to provide information to public officials is the National Pipeline Mapping System (NPMS). Resources are available to easily identify transmission pipelines within or near a given community. OPS maintains the NPMS, a geographic information system (GIS) database that contains the locations and attributes of hazardous liquid and gas transmission pipelines operating in the United States. The NPMS is updated with mandatory annual submissions of pipeline geospatial data by pipeline operators. One important function of the NPMS is to support queries by members of the public to identify which hazardous liquid and gas transmission pipeline companies operate pipelines in a specific county or zip code. This allows local governments to locate transmission pipelines within or near their communities and to determine areas that could be impacted by releases from these pipelines. OPS will provide raw NPMS geospatial data to county and state officials upon request.

Minimizing Incident Consequences

As noted at the beginning of this report, trends in the frequency of pipeline incidents are moving in the right direction. However, for a variety of reasons, not the least of which is population encroachment on pipeline right-of-ways, the consequences of some accidents continue to be very severe. A challenge for operators and regulators alike is therefore to reexamine the effective means for minimizing incident consequences, including location and remote actuation of shutoff valves and improvement of leak detection systems.

Ongoing Initiatives - Pipeline operators seek to reduce the risk of releases by taking measures to minimize the probability and consequences of such releases. These measures include proper pipeline route selection, design, construction, operation, and maintenance, as well as the use of automated monitoring and control systems, integrity management programs, public awareness programs, and excavation damage prevention programs.

Transmission pipeline operators also conduct emergency response drills and exercises - both on their own and in cooperation with local emergency responders - to ensure that emergency preparedness and response planning is adequate should a pipeline incident occur. Also, gas transmission pipeline operators are required by regulation to reduce the operating pressure of their pipelines and make other adjustments to operations and maintenance based on criteria related to increasing populations near their pipelines. These requirements come into effect if additional residences or places of public assembly (schools, hospitals, nursing homes, parks, etc.) are constructed near a gas transmission pipeline. Finally, both the pipeline industry and its regulators are preparing to reexamine effective means for minimizing incident consequences, including location and remote actuation of shutoff valves and improvement of leak detection systems.

Managing Safety beyond Compliance with the Regulations

While pipeline safety regulations provide the baseline for effectively managing safety, operators continue to undertake safety-motivated activities beyond those required for compliance. A few of these are summarized in this section.

As noted earlier, there are a few areas not currently regulated by the state and federal safety regulators that are important to pipeline safety. Three important challenges associated with these unregulated areas are how operators can best promote positive safety cultures; how to promote replacement of pipe constructed from materials currently viewed as being high risk - including appropriate reimbursement mechanisms; and how to promote the interchange of information among operators on safety management practices of demonstrated effectiveness in addressing key safety issues.

Overall Focus on Performance Improvement

In recent years trade associations from various industry segments have taken the lead in promoting industry focus on performance improvement. Three overarching examples of these efforts are noted below, and specific initiatives are summarized elsewhere in this section.

Performance Improvement Processes - Hazardous Liquid Pipeline Industry

Members of the American Petroleum Institute (API) and the Association of Oil Pipe Lines (AOPL) strive for continuous improvement in pipeline performance. API and AOPL have created and conduct several performance improvement processes to learn from experience and build on the hazardous liquids pipeline industry's success in reducing pipeline accidents.

Through these initiatives, pipeline operators work to share ideas for improvements and best practices, and learn from pipeline incidents. Standing teams and workshops are organized to discuss incidents and near misses, analyze data, share best practices, and make recommendations for action. The industry invests in research and development to develop new technologies and practices to confront pipeline challenges.

The major ongoing projects and teams are identified below:

- Pipeline Performance Tracking System, for reporting and analyzing industry spill and accident data
- Environment and Safety Initiative, including the Performance Excellence Team
- API Committees and Teams
- API Pipeline Information eXchange
- Safety Culture Forums
- Pipeline safety research and development
- Industry involvement in pipeline safety standards; API and other Standards Development Organizations

Pipeline Safety Task Force - Gas Transmission Pipeline Operators

Late in 2010, the Interstate Natural Gas Association of America (INGAA) established its pipeline safety task force. The task force has been designated as part of a renewed industry commitment to the principles of integrity management. In addition to taking leadership of the industry effort to understand and improve safety culture for both INGAA member companies and their suppliers, the task force intends to provide leadership in working with regulators and other stakeholders toward the common goal of safe transportation of natural gas. Thus far the task force has published five guiding principles for pipeline safety, shown below.

1. Our goal is zero incidents - a perfect record of safety and reliability for the national pipeline system. We will work every day toward this goal.
2. We are committed to safety culture as a critical dimension to continuously improve our industry's performance.
3. We will be relentless in our pursuit of improving by learning from the past and anticipating the future.
4. We are committed to applying integrity management principles on a system-wide basis.

5. We will engage our stakeholders—from the local community to the national level - so they understand and can participate in reducing risk.

In addition, the INGAA Board has approved development of nine action plans on which to focus its efforts. The nine action plans as shown below.

1. Expand Risk Management Beyond HCAs
2. Pipeline Anomaly Management
3. Demonstration of Fitness of Service on Pre-Regulation Pipelines
4. Pipeline Isolation and Response
5. Integrity Management Communication and Data
6. Implementation of the "Pipelines and Informed Planning Alliance" Guidance
7. Evaluate, Refine and Improve Threat Assessment and Mitigation
8. Implement Management Systems across INGAA Members
9. Stakeholder Engagement and Emergency Response

Pipeline Safety – Gas Distribution Operations

In 2006, the American Gas Association (AGA) established a Board of Directors Safety Committee. This committee, comprised of member utility presidents, CEOs, and top safety leaders, developed AGA's safety action plan, has established AGA's Safety Culture Statement, holds an annual executive leadership safety summit, and provides oversight to the association's safety initiatives and programs.

In addition to the Board of Directors Safety Committee, AGA has 14 operations committees comprised of technical experts that produce industry publications, conduct roundtables and hold safety and operations related sessions. These committees serve as forums for companies to exchange information and strategies on safety programs and to promote system integrity. In 2010, AGA held over 60 operations and safety related events reaching 2700 natural gas representatives.

AGA's Operations Best Practices Program involves collecting data, identifying leading performers and innovative work practices that can be used to continuously improve gas pipeline operations. Best Practices Roundtable discussions are held to discuss problems, identify solutions that have worked for others and provide participants the opportunity to exchange management strategies and work practices.

The SOS program allows AGA members to query the industry for solutions and practices to operational challenges. SOS summaries are provided to members to facilitate the exchange of information.

<u>Learning from Experience - Identifying Areas for Improvement</u>

As for operators, perhaps one of the most fruitful areas for understanding the factors that affect pipeline safety is lessons gained from operating and incident experience. Effective mining of the various sources of experience information and use of the insights gained remain a major challenge to both pipeline operators and regulators. A challenge that is distinctive to regulators, but shared in part by industry trade associations, is understanding the implications of operating and incident experience across the pipeline industry and determining how best to adjust its approach to regulating and overseeing pipeline operators in the light of that experience. A major challenge associated with learning from experience is assuring that the data from which lessons are extracted is of sufficient quality to ensure the validity of the lessons.

A major source of data for lessons learned processes discussed below is the data reported by operators to OPS. Operators are required to report information about the characteristics of the systems they operate as well as to notify OPS of incidents at the earliest practical moment after they occur, then to follow up with supplemental information as the details of the incident become clearer. States, operators and OPS all carry out incident investigations and prepare Failure Investigation Reports on noteworthy incidents.

Ongoing Initiatives

Learning from pipeline operating and incident experience is critical for safety improvement. Ongoing efforts in this area involve not only the pipeline industry and the Federal and state regulatory agencies, but also the National Transportation Safety Board (NTSB) in its role overseeing the effectiveness of OPS. The following represent the most significant ongoing efforts in this area.

Evaluating Underlying Causes of Events - Operators, regulators and the National Transportation Safety Board (NTSB) are all involved in evaluating the causes of pipeline incidents. The NTSB is charged by Congress with determining the probable cause of transportation accidents, promoting transportation safety, and assisting victims of transportation accidents and their families. NTSB investigates only *major* pipeline accidents. As a result of its investigations the NTSB identifies probable causes and issues recommendations to any operator or regulator involved in the incident. In addition, the NTSB maintains a listing of "Most Wanted" safety improvements, which it closes as satisfactory only when it is satisfied the issue has been fully and responsible addressed. Current investigations can be found at http://www.ntsb.gov/investigations/current.html .

Gathering and Understanding Performance Data - OPS has been working for the past several years toward becoming a data-driven organization. Toward this end it has established an organizational focal point for gathering, assuring the quality of and evaluating the data it collects. In addition to producing periodic reports on industry performance displayed on its stakeholder communication web site, OPS is currently using available data to improve its operator evaluation process with the objective of better focusing its inspection resources.

Plastic Pipe Database Committee (PPDC) - The distribution pipeline industry has worked with its regulators for many years systematically assembled and evaluated performance data. The earliest focus of these efforts was the Plastic Pipe Database Committee (PPDC). Following the issuance of an incident investigation and report that identified the cause of a 1994 incident in Waterloo, Iowa as "brittle-like cracking" of plastic pipe, the National Transportation Safety Board recommended that OPS determine how susceptible older plastic materials were to "brittle-like cracking." Through its trade associations, the industry agreed to work with the regulatory community to voluntarily collect accurate and pertinent information to be placed into a secure database. The PPDC is a group of representatives of federal and state regulatory agencies and the natural gas and plastic pipe industries whose goal is to create a national database of information related to the in-service performance of plastic piping materials. This database is currently supporting analysis of the frequency and causes of in-service plastic piping material failures. The PPDC also communicates the results of its analyses to operators whose systems might include any material identified as potentially higher risk. More information on the PPDC can be found at the following link:
http://www.aga.org/Kc/OperationsEngineering/ppdc/Pages/default.aspx .

Pipeline Performance Tracking System (PPTS) - Since 1999, many hazardous liquid industry companies have reported spill data to the industry's Pipeline Performance Tracking System (PPTS). Currently, operators of about 85% of total US hazardous liquids pipeline miles under OPS jurisdiction are reporting to PPTS – they report on more than those miles as spills from all assets are reported. These data are reported similarly to the requirements in new OPS Form 7000-1. The industry uses OPS and PPTS data to analyze and improve its performance. The stated philosophy of PPTS is to measure, learn, manage and improve. Through PPTS, the industry develops metrics for evaluating changes in pipeline performance, evaluates and sets leading performance measures for the pipeline industry, and identifies leading and lagging indicators that may predict future performance. The industry produces reports called advisories from the PPTS data that includes considerations for operators. Advisories may be viewed by the public. PPTS data helps provide actionable recommendations to the pipeline industry targeting continuous performance improvement and solutions addressing today's and tomorrow's challenges.

The Environment and Safety Initiative (ESI) – This is hazardous liquid pipeline industry executive-led initiative started in 2001 to try to promote sharing of industry lessons, develop and apply leading indicators of performance, and improve overall industry performance with actionable recommendations.

The Pipeline Information eXchange (PIX) - Since 2008, API's Operations & Technical Group has sponsored the annual Pipeline Information eXchange or PIX. This is a closed-door meeting in which operators present the details around accidents and near misses that have occurred, including what was learned from them and what was done as a result to fix problems. These forums are designed to encourage frank, open discussions where operators can learn from one another so that similar accidents can be avoided.

INGAA Data Committee (DATCOM) - The Interstate Natural Gas Association of America (INGAA) has been focusing on data evaluation for decades, with increased focus since the early 2000's. To support this effort INGAA has organized data committee (DATCOM) whose mission is to: "*Develop, collect, analyze and communicate the results of INGAA-member company-provided data, including information on detection, remediation, prevention and mitigation actions undertaken related to pipeline safety activities; and to improve pipeline safety by utilizing this data to measure the efficacy of our action and increase transparency through stakeholder communications.*" Over the years well before the commissioning of DATCOM, INGAA member companies have evaluated their performance data and prepared reports on their findings and implications for member companies.

Developing and Sharing Best Practices

As with insights from failure cause analysis, the major pipeline industry stakeholders are all involved in communicating lessons from incident investigations and on noteworthy operating practices. OPS' most used form of communication on safety significant issues is the Safety Advisory Bulletin. When new information becomes available that may be relevant beyond the operator that experienced an incident, OPS typically issues such a bulletin. Information on Safety Advisory Bulletins dating to 1980 is located at http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin .

Several trade associations have standing working groups to evaluate safety and operational practices submitted by its members and to communicate the most generally applicable of these best practices among their member companies. Often access to best practices is restricted to companies that participate in the working groups.

Operations Best Practices Benchmarking - An example of such a program is that administered by the American Gas Association (AGA). Considered as one of AGA's most valuable programs, the AGA Operations Best Practices Benchmarking is an effort to identify procedures of superior-performing gas industry companies and innovative work practices that can be used to improve participants' operations and reduce cost. The Program is comprised of three areas: Gas Distribution with 70 or more participants, Gas Transmission with approximately 40 participating companies, and Supplemental Gas (LNG and LPG) with 30 companies. In each area AGA identifies six or seven topics of interest each year; uses questionnaire to obtain perspectives from interested member companies, analyses operator responses, then selects participants based on performance, and facilitates a discussion among interested operators.

INGAA began an Integrity Management Continuous Improvement initiative late in 2010. This initiative is made up of executives and technical experts to lead action plans to enhance public safety.

Ongoing Regulatory Initiatives - Requirements for pipeline operators to publicly report the types of materials in their pipelines, and their history of incidents for different types of pipes have evolved considerably over the years. Accident reporting forms have been revised and improved several times over the past decades, and a major revision intended to significantly improve OPS' analytical capabilities was implemented in January of 2010. Following on this effort, OPS has completed a major revision of all of its infrastructure reporting forms - again for improved analytical capabilities - with the changes taking effect beginning January of 2011.

The recent distribution integrity management rule will require distribution operators to categorize by material the number of hazardous leaks either eliminated or repaired. With this data, they will be able to monitor the relative frequency of hazardous leaks on pipe made from various materials such as cast iron, bare steel, plastic pipe, etc. This data monitoring will help operators get a much better picture of the aging infrastructure, but it is just getting started. While the reporting requirements are new, many operators have monitored the performance of suspect material for years, and have used the results of this monitoring to justify the need to replace certain types of pipe.

Improving & Maintaining a Positive Safety Culture

Of all of the unregulated factors affecting an operator's performance, perhaps the most important is its safety culture. Careful investigations of many serious accidents in all industries have identified a negative safety culture as the underlying cause. Strong safety performance requires a degree of vigilance and safety focus that is far beyond the bounds of a culture of compliance - involving compliance with the letter not the spirit of regulations. Strong executive-level safety leadership, improving trust through better communication, and increased operator transparency are all characteristics of a positive safety culture.

Ongoing Initiatives - Safety culture is a dynamic topic in the pipeline industry. Most of the activity is focused on better understanding the characteristics of a positive safety culture and sharing experiences on how to develop one. These discussions typically occur in workshops such as those sponsored by INGAA in July of 2008, March of 2009 and May of 2010.

Likewise, AOPL is using executive level safety culture forums to better understand the role of safety culture and how to promote a positive safety culture. In this approach, a team of senior professionals from the AOPL Performance Excellence Team (PET) identifies safety topics of concern across the industry and conduct safety culture forums for company executives at industry leadership meetings throughout the year. Through these discussions, executives share the safety policies and programs that they have found effective and help each other to boost industry safety through the leadership ranks.

In February 2011 the American Gas Association (AGA) and its member companies issued a statement on safety culture. In the statement the companies committed to promoting positive safety cultures among their employees throughout the natural gas distribution industry. All employees, as well as contractors and suppliers providing services to AGA members, are expected to place the highest priority on employee, customer, public and pipeline safety. The characteristics of a positive safety culture were described.

The full statement can be found at http://www.aga.org/our-issues/safety/Documents/AGA%20Safety%20Culture%20Statement_Feb%202011.pdf . Means to promote characteristics of a positive safety culture are explored at periodic workshops.

Managing the Business while Ensuring Safety

Adequacy and Focus of Resources

Effectively applying limited resources

Ultimately the effectiveness of an operator's efforts to manage the integrity of its pipeline system depends on the financial and staff resources available to it, and how well these resources are used. The challenge for operators of regulated pipelines is to balance the resource requirements to safely operate pipelines with the interests of customers and other stakeholders in the ratemaking processes.

As in nearly every enterprise, resources to manage pipeline safety are limited. As discussed in Section 2, the funds available to an operator, whether transmission or distribution, whether private or public are controlled by various agencies that regulate the rates companies can charge to transport and deliver gas and oil.

Operator challenges exist in identifying their resource needs, in communicating these needs and the implications of receiving less to rate setting agencies, in dealing with the political forces that affect decisions on resources, and ultimately in managing their operations with the resources they have.

Recent experience has demonstrated that, even in the face of severe and highly visible incidents such as occurred in Allentown Pennsylvania in 2010, legislative bodies, faced with very real state budgetary pressures, sometimes fail to support decisions by public utility commissions to increase rates to address the underlying causes of an incident.

Ongoing Initiatives - Perhaps the most important set of resource-related initiatives directly affecting an operator's management of pipeline safety are the efforts by operators of gas distribution companies to propose and seek rate adjustments from state rate regulators to fund programs to replace high-risk pipe. When a gas utility identifies a large group of facilities in its distribution system as requiring replacement, the utility manages this through a multi-year program that is agreed upon in a rate case or under a rate treatment agreement with the state public utility commission and public advocates. Approximately 22 states have infrastructure replacement cost recovery mechanisms; other states may not have received a proposal on which to base incentive programs. Public Utility Commissions use "smart modernization" to coordinate pipeline infrastructure improvements with other portions of the utility infrastructure. For more information on programs in individual states see Appendix 2.

Smart Modernization - AGA has actively promoted "smart modernization" of the nation's pipeline infrastructure. In this context "smart modernization" starts with determining a pipeline's fitness for service. If a pipeline's fitness for service is questionable, then actions are taken on a risk-prioritized basis (repair, rehabilitation, replacement or requalification) and these actions take into account the impact on the customer. The "smart" aspect involves two features. First an operator uses a risk evaluation process that allows it to risk-rank the severity of pipeline integrity concerns, and to differentiate among the best approaches to resolve identified integrity concerns. Second, an operator explicitly takes into account the impact of the modernization activity on its customers, including safety, service reliability and cost of service.

Broad mandates to rehabilitate replace or requalify a vintage or type of distribution pipeline material may be counter to pipeline safety because they are not risk-based. Requiring scarce resources to be used to replace facilities that are dated but performing well effectively limits the availability of resources to rehabilitate, replace or requalify higher risk facilities that demonstrate poor condition or performance.

Ongoing Regulatory Initiatives - In March 2011, the National Association of Regulatory Utility Commissioners (NARUC) established a formal task force to coordinate and direct the Association's safety advocacy. The task force will interact with NARUC member commissioners, the federal government, and consumer and industry stakeholders to analyze pipeline safety issues, discuss best practices, and lead the NARUC advocacy before congress and federal agencies. An early issue being addressed by the task force is current practices by state PUCs in reviewing and approving funding of pipe replacement programs.

Integrated Inspections - Over time, OPS has used a variety of inspection approaches. These include the following types of inspections: standard unit inspections, team operation and maintenance (O&M), new construction, operator qualification (OQ), integrity management, and accident investigations. Traditionally each of these different inspection types is performed as separate activities with minimal coordination and consideration of overlapping areas of interest.

As additional inspection types have been added, this "discrete" approach can lead to inefficiency and duplication of effort. In addition, the discrete inspection approach does not generally focus on specific areas of perceived operator risk or deficient performance. Instead each type of inspection uses the entire set of inspection questions for that area. To better address the inefficiencies of the current inspection approach and to better focus inspection resources on areas of known or suspected risk, OPS is developing an integrated inspection (II) process and supporting tools.

Integrated inspections (IIs) are based on the principle that all operators and all inspection units should not be treated the same. IIs are designed to provide OPS the needed flexibility in determining the scope of the inspection, the depth in which certain areas are covered, and the interval between inspections. Full implementation of integrated inspections is expected to result in more efficient and focused utilization of inspection resources as well as better information on which future resource allocation decisions can be made.

Retaining expertise while losing experienced people - aging operator and regulator workforce

The pipeline industry workforce is getting older. While locating inexperienced people to replace them as they retire or move into more senior positions is not a serious challenge, developing the new people to ensure that the knowledge and expertise of the people they are replacing is not lost will be a continuing challenge.

Ongoing Initiatives - Based on a 2007 INGAA Foundation report, the natural gas transmission industry has a number of initiatives underway to meet the workforce challenges. The 2007 report - "*Securing Our Future: Developing the Next Workforce"* report suggests the need for an industry-wide strategy to recruit new talent for the future. In 2009 the Foundation followed with another study, "*Critical Skills Forecast For the Natural Gas Transmission Industry",* that forecasts the most critical skills for the natural gas pipeline industry workforce. This study gives the industry a place to focus efforts to enhance skill development. Existing staff must be engaged in the development of new people who can replace them when they move on or retire. Replacing an aging workforce is a significant challenge in the pipeline industry.

Pipeline Safety Research, Development and Demonstration (RD&D)

For many years OPS has conducted and supported research, development and demonstration. These activities support regulatory and enforcement activities by providing the technical and analytical foundation necessary for planning, evaluating, and implementing the pipeline safety program. The Congressionally-mandated focus of the program is on research, development and demonstration projects that provide near-term solutions to improve the safety, reduce the environmental impact, and increase the reliability of the Nation's pipeline system.

Technological innovation has been and continues to be a major driver in pipeline safety improvement. As an example, the in-line inspection tools that are a fundamental part of today's integrity management programs were primitive and unreliable tools twenty years ago. Many of the current safety issues could be better managed if improved technology were available. Examples of areas in which technological innovation would help include leak detection technology, improved in-line inspection tools for difficult to pig lines, and improved ability to identify and characterize cracks in gas transmission pipelines.

Ongoing Initiatives - Since its expansion in 2002 the OPS RD&D program has committed and managed over $146 million of which over $64 million was direct federal funding and the remainder matching funds from industry sources. Other research management organizations which both collaborate with OPS and fund their own pipeline safety research include the Gas Technology Institute (GTI), NYSEARCH, and the Pipeline Research Council International (PRCI).

Managing the Regulatory Process

Choosing the Best Regulatory Approach and Regulations

The earliest pipeline safety regulations, adopted from National Consensus Standards issued by the American Society of Mechanical Engineers (ASME) were for the most part highly prescriptive. Pipelines were to operate within prescribed limits on stress (dictating the maximum operating pressure), were to be equipped with corrosion (cathodic) protection systems that were to operate within prescribed limits, and were to be buried a prescribed depth when constructed. These requirements have proven to be highly effective.

As pipeline systems have become more complex with greater variations in construction materials, operating environment and materials being transported, new regulations have evolved from highly prescriptive to greater focus on operator safety performance. These "performance-based requirements" include many provisions in the gas and liquid transmission pipeline integrity management program (IMP) regulations, and virtually the entire distribution systems integrity management program (DIMP) regulation. While these regulations allow the operator greater flexibility in determining exactly how it satisfies the requirements, thereby allowing consideration of unique threats and characteristics of systems, they add considerably to the need for inspectors to exercise judgment in whether or not an operator has actually complied with the regulation. This need for inspector judgment imposes an added burden on inspectors to document the basis of their judgment and the enforcement staff to ensure the strength of the basis for the inspector's judgment.

Since the performance-based regulations are still relatively new in pipeline regulation, regulators must still address the challenge of determining whether the value of the flexibility they offer operators outweighs the difficulty regulators have in inspecting and enforcing compliance. In the future a balance of prescriptive and management system regulations will continue to exist.

Other regulation-related challenges the regulator must face include: promoting consistency among regulatory agencies in regulations and their interpretation; closing statutory gaps and preventing overlaps with other regulators; and determining which of the very numerous good ideas for new requirements have the greatest potential for improving safety.

Ongoing Initiatives - OPS continues to explore how best to strengthen current regulations by working toward a complete and prioritized regulatory agenda. An Advanced Notice of Proposed Rulemaking (ANPRM) has been issued for onshore hazardous liquid pipelines, and an ANPRM is in development for gas transmission pipelines.

Adequate Number of Qualified Inspectors

Federal and state inspectors are all required to successfully complete a comprehensive training program before they are considered completely qualified as inspectors. Needless to say, this training gives new inspectors considerable insight into what regulators are looking for in operator compliance, and therefore makes them excellent candidates for employment by industry. This training combined with the often non-competitive salary scales, especially in the states, leads to a significant challenge in retaining qualified inspectors. Even the federal government has hired away the most qualified and experienced state inspectors and managers to strengthen OPS' regulatory programs. This situation is particularly challenging since compensation of state inspectors is usually mandated by state statute, even though the Federal government is currently paying for up to 80% of the cost of state pipeline inspection programs.

Ongoing Regulatory Initiatives - Perhaps the most important resource-related initiative directly affecting the regulators of pipeline safety is the direction in the PIPES Act of 2006[14] that authorizes OPS to provide state pipeline safety grants of up to 80% (increased over the previous 50%) of the state program cost. Overall economic deterioration since 2008 has adversely impacted the ability of some states to adequately support their pipeline safety programs, even in the light of these increases in federal grant funds.

Consistent with its objective of being a data-driven risk-focused organization, OPS continues to develop data analysis capability, and models to support assignment of its resources both in headquarters and in the field. Furthermore, as discussed above, OPS is developing an integrated inspection program to support more effective use of its inspection staff.

Adequacy of Enforcement

For the past several years OPS has worked to improve its enforcement program. While much progress has been made, challenges still exist in determining whether enforcement as currently practiced and as developing is improving safety by driving the best solutions to important safety issues, especially at those very few operators that view operating at minimal compliance or even cost-effective non-compliance as an obligation to their shareholders. What have the states done?

[14] Pipeline Inspection, Protection, Enforcement, and Safety Act Of 2006, Public Law 109–468—Dec. 29, 2006.

Appendix 11
Summary of State Responses to Survey on Staff Size Changes

Input due from Zach

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